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# OIL & GAS JOURNAL
# DATA BOOK

## 1991 EDITION

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1991 EDITION

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# FOREWORD

The milennium's last decade began much the same as the preceding decade: skittish oil markets apprehensively watching the specter of war hover above the Persian Gulf and worrying about the direction of oil prices.

In 1990, oil markets underwent one of the most turbulent years in memory. As the year began, industry executives were predicting a return to stability for oil and gas supply and demand in the 1990s. Oil & Gas Journal Energy Database's fourth semiannual survey of industry and government forecasters reflected an overall sense of optimism about oil markets in the 1990s. Generally, they predicted a tightening of supply during the decade as U.S. and Soviet crude production continues to slide. The forecasters also saw demand continuing to rise during the decade, especially among the rapidly industrializing nations of the Asia-Pacific region and the born-again economies of what had been the Communist bloc. One certainty, prognosticators concurred, is that the environment would be the overwhelmingly dominant issue of the 1990s.

A glance at the headlines as 1991 dawned would suggest that the industry forecasters are about as accurate as the supermarket tabloid psychics in their annual New Year's Eve predictions for the year. But then, the Middle East has always been a wild card for oil markets. The prospect of war loomed in the Persian Gulf as a U.S.-led international force prepared to drive invading Iraqi forces from Kuwait after a five-month trade embargo failed to accomplish that. Oil prices had almost doubled in the months following Iraq's August 2 blitzkrieg invasion and takeover of Kuwait, pulling up products prices with them and threatening to undermine the economies of the embryonic democracies in eastern Europe.

Only a few weeks before the invasion, an agreement among members of the Organization of Petroleum Exporting Countries (OPEC) resulted in production cuts and success at achieving a $21/bbl benchmark oil price. That accord capped months of wrangling among OPEC producers that had brought oil prices to the brink of collapse.

The Persian Gulf crisis spurred analysts to devise an array of scenarios for the direction of oil prices, depending on how events unfolded in the region. They ranged from a peaceful settlement, under which a return to $18–20/bbl was quickly achieved, to all-out war with loss of Saudi production, under which $80–100/bbl oil was conceivable.

No sooner was the ink dry on written forecasts that held $30/bbl oil to be the new floor for oil prices, did Saudi Arabia, Venezuela, the United Arab Emirates, and others in OPEC ramp up production to offset the loss of 4.3 million b/d of Iraqi and Kuwaiti crude exports resulting from the embargo. Meantime, oil demand fell, owing to an already soft world economy weakened further under the weight of oil prices that averaged $30–40/bbl for much of the fourth quarter. The immutable law of supply and demand was working the other direction again, and oil prices ranged $25–28/bbl in December 1990.

The Saudis surprised almost everyone with the speed and scope of their expanded production, jumping output by restoring shut-in wells and mothballed processing equipment to service. Saudi flow increased to 7.6 million b/d by late November from 5.4 million b/d just before the invasion. In December, Saudi production was expected to average 8.5 million b/d.

Suddenly, the market outlook began to take on a bearish cast. With demand dropping because of higher oil prices and an economic slowdown and crude output rising, was there going to be too much oil on the market? The crystal balls were dusted off again, and some were predicting an oil price collapse in second quarter 1991 even if the standoff in the Persian Gulf persisted. OPEC ministers were warning of a price collapse in 1991 if quick adherence to the July 1990 production accord was not forthcoming soon after the resolution of the crisis.

Another ominous portent on the horizon had bullish overtones for oil prices: the slide toward chaos in the Soviet Union. The world's biggest oil producer saw its crude production plunge 5.3% to an average 11.5 million b/d in 1990. That in turn sliced Soviet oil exports — a desperately needed source of hard currency — to its lowest level since 3.33 million b/d in 1985, compared with a peak of 4.1 million b/d in 1988. The latest what-if scenarios conjured up visions of a further loss of crude exports from the market if the tottering Soviet economy and political system collapsed with civil unrest and rebellion among the Soviet republics.

Whatever the scenario, OPEC — and notably the Persian Gulf members of that organization — will be at the heart of it. OPEC 1990 crude production averaged 23.2 million b/d in July, fell to 19.9 million b/d with the loss of exports from Iraq and Kuwait, rebounded to 22.2 million b/d in September and October, and climbed to 23.4 million b/d in November and December. OPEC output of condensate and natural gas liquids rose as well in second half 1990, reaching 2 million b/d by yearend, up from 1.9 million b/d in July and 1.8 million b/d in August.

Could OPEC oil production surpass those levels in 1991? The Saudis plan to hike productive capacity to 10 million b/d by the mid-1990s. With supply and demand coming into balance at yearend 1990 even without Iraq and Kuwait's exports, accelerating the Saudi program would only depress the market further. As this book goes to press, the extra $4–7/bbl or so inflating oil prices is a nervous market's war premium. Without that, there is no incentive to accelerate the Saudi program. If the stalemate drags on, that diminishes the chance of war and thus squeezes the price premium.

Venezuela jumped its crude production by about 500,000 b/d to 2.5 million b/d in the wake of the Iraqi invasion. It hopes to expand productive capacity to more than 3.5 million b/d by the mid-1990s, but that will call for a $25 billion investment program.

Iran, still recovering from its war with Iraq, is not likely to surpass its yearend 1990 productive capacity of about 3.4 million b/d anytime soon. Nigeria is probably at peak for the near term with 2 million b/d, as is Libya with 1.5 million b/d.

What of the prospects for increasing non-OPEC production? U.K. production has been plagued with safety-related supply disruptions in recent years, and 1991 won't be an exception. The earlier disruptions were often the result of accidents, and those in 1990–91 would be the result of safety measures, particularly the shutdown of facilities to allow installation of emergency shutdown valves. Other factors in North Sea oil production shortfalls are related to labor problems and maintenance work. As a result, U.K. crude production in 1991 is not likely to surpass the 1.89 million b/d estimated for 1990. Off Norway, the start-up of several new fields in tandem with peaks from established producers will have pushed Norwegian flow to a record 1.8 million b/d in early 1991.

The United States has little chance of increasing its oil production, even with an all-out effort pushed by the Department of Energy in the wake of the Iraq-Kuwait embargo. Although Alaskan North Slope producers took steps to spike oil production by 250,000 b/d in 1990–91, that would be only a temporary blip in the continuing decline of North Slope output paced by Prudhoe Bay's slide. And it would fall far short of offsetting declines in the Lower 48, resulting in a net decline in production in 1991 of perhaps 150,000 b/d from 1990 levels. Still, that is an improvement. U.S. crude output fell by 5.2% in 1990 to 7.2 million b/d.

Canadian oil production continued its decline in 1990, registering a 3.2% drop from 1989 levels. Only an ambitious program to build tar sands/bitumen output and develop offshore discoveries will turn that trend around in the 1990s.

The rise in oil prices in second half 1990 has yet to translate to a significant increase in production outside OPEC, nor were companies doubling and quadrupling drilling budgets as they did in the late 1970s and early 1990s. There were some healthy increases in capital budgets announced at yearend 1990, and that will mean an increasing rig count in 1991. Much of that increased drilling will target natural gas, as the consensus grows that the U.S. gas supply deliverability bubble is almost at an end. For much of 1990, the split in the U.S. active rig count between rigs drilling for oil vs. gas was often even, at some points tilted in favor of gas. At the beginning of the second half, the tilt to gas stemmed from a rush to capitalize on tax incentives for coalbed methane and tight gas sands that were scheduled to expire that year. However, the tax credit was renewed, presaging continued growth in that segment of rig activity.

On the refining side, companies face some daunting tasks. U.S. refiners must cope with a whole new slate of fuels and fuel specifications under mandates of a newly reauthorized Clean Air Act during the 1990s. Tighter standards on air emissions will be aimed at fuels and refineries elsewhere in the world this decade. At the same time, refiners in the United States and elsewhere must contend with a capacity squeeze as demand for lighter products continues to grow and the world crude slate grows more heavy and higher in sulfur. There was a foretaste of that dilemma in second half 1990, when the loss of Kuwait's sophisticated refining capacity took more than 750,000 b/d of complex processing capability out of the supply picture and much of the increased OPEC production was heavy crude. Despite the problems refiners will face in the 1990s, the tightening capacity squeeze will help keep that sector highly profitable during the decade, assuming oil prices return to precrisis levels.

Petrochemical operations face a sobering prospect in the 1990s after a buoyant period during the late 1980s: a shakeout caused by overbuilt capacity and sagging demand brought on by economic doldrums. There will be some bright spots, however, notably for octaine enhancers such as MTBE and for products in great demand in developing nations, such as styrene and polypropylene.

Behind all the data in this book is the implicit question: What will happen to the oil and gas industry in the 1990s — especially a pivotal year like 1991? Perhaps it will prove to be another turbulent year, as 1990 was. Perhaps expectations of war and crisis and recesssion will not be fully born out, and once again, market stability and environmental concerns will be the key watchwords of the oil and gas industry in the 1990s.

Crystal ball gazing is an often fruitless but necessary practice in the petroleum industry. The only consistently accurate vision is hindsight, however. It is through the prism of statistics and factual details that the *OGJ DataBook* seeks to provide this hindsight.

Bob Williams
Senior Staff Writer
*Oil & Gas Journal*

# Total revenues up, profits down for OGJ400

**Robert J. Beck**
Economics Editor

**Joan Bonfield Biggs**
Statistics Editor

OGJ 400

Total earnings sagged in fiscal 1989 for the OGJ400 group of U.S. public oil and gas companies.

Net income for the group dipped 8.6% to $20.34 billion from $22.27 billion in 1988. Net income had moved up sharply the previous 2 years—80.2% in 1987 and 137.6% in 1988 after plummeting in 1986.

The group's total assets increased 0.3% to $469.8 billion. But the growth was concentrated. Assets of the 20 largest companies increased $12 billion, those of the entire group only $1.3 billion.

The 1989 earnings slump was mainly due to extraordinary charges posted by several large companies, related to environmental issues.

The lower net income reduced several measures of profitability. The other measures of financial and operating performance of the group were generally lower and to some extent represented caution about future trends in demand and price.

Capital and exploratory spending by the group was down, and net wells drilled dropped significantly.

The bright spots for the group in 1989 were increased revenues due to higher crude oil and product prices and increased production of natural gas in the U.S. and worldwide.

Operating earnings from industry segments were the reverse of a year earlier, with upstream earnings improving and downstream earnings falling.

Upstream profits were boosted by a jump in the average price of crude oil, a small increase in natural gas prices, and an increase in natural gas production. This was partly offset by a decline in U.S. crude production.

The average wellhead price of crude oil in the U.S. increased 26% in 1989 to $15.85/bbl. The wellhead price of natural gas increased 1.2%. Total U.S. gas production increased 0.8%, and crude output fell 6.5%.

At the same time, downstream earnings weakened due to smaller margins resulting from feedstock costs' advancing more rapidly than product prices. The refiner acquisition cost of crude oil in the U.S. increased 22.5%; the wholesale price of motor gasoline moved up 13.5%.

The thinner margins were partly offset by increased demand for petroleum products. U.S. demand moved up 42,000 b/d—0.2%—in 1989, and worldwide demand in free-market economies rose 1.2 million b/d—2.3%.

### Drilling dips

Even though wellhead prices were up in 1989, drilling activity fell to one of the lowest levels on record. The average number of active rigs drilling in the U.S. in 1989 fell to 869, the lowest level since 1942. Well completions dipped 12% to 28,340. The weakness showed up outside the U.S. The international rig count fell 10% in 1989 to average 922 active rigs.

This weakness in the upstream segment reflects uncertainty in the industry about crude oil prices, which have been on a roller-coaster ride the last several years.

Crude oil prices fell sharply in 1986 due to overproduction by members of the Organization of Petroleum Exporting Countries. The average wellhead price in the U.S. fell 48.1% in that year to $12.51/bbl. Some production discipline in late 1986 and 1987 pushed the 1987 average price to $15.40/bbl.

In 1988, however, OPEC

*Some key changes from 1989 OGJ400**

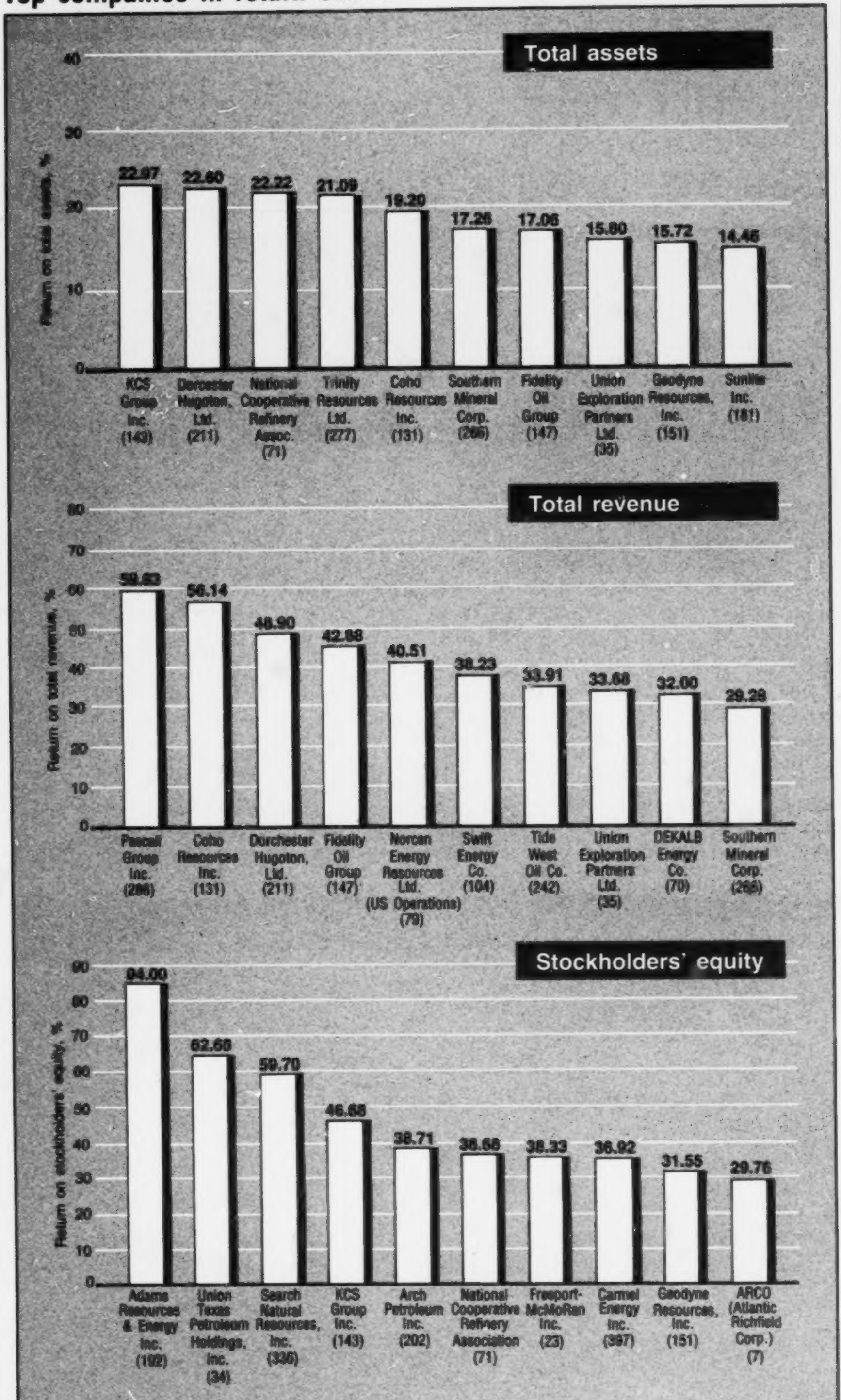
| How company appeared on last year's list | Why change? | How company appears on this year's list |
|---|---|---|
| Albion International Resources, Inc. | Acquired by | [illegible] |
| Chapman Energy Inc. | Name changed to | Coda Energy, Inc. |
| Grace Natural Resources Group | Completed public offering | Grace Energy Corp. |
| Houston Oil Trust | Acquired by | Seagull Energy Corp. |
| KenCope Energy Companies | Name changed to | [illegible] |
| Kimbark Oil & Gas Co. | Merged, changed name to | [illegible] Petroleum Co. |
| Mustang Resources Corp. | Name changed to | Blue Dolphin Energy Co. |
| NRM Energy Company, L.P. | Name changed to | Edisto Resources Corp. |
| Pend Oreille Oil & Gas Co. | Acquired by | Grace Energy Corp. |
| Petrotech, Inc. | Name changed to | Great Northern Gas Co. |
| Pinnacle Petroleum Inc. | Acquired by | Golden Oil Co. |
| The Quinoco Companies | Acquired by | Hallwood Energy Partners L.P. |
| Republic Resources Corp. | Name changed to | Republic Waste Services |
| Resource Exploration Inc. | Name changed to | Resource America, Inc. |
| Santa Fe Energy Co. | Reorganized | Santa Fe Energy Resources Inc. |
| Santa Fe Energy Partners L.P. | Reorganized | Santa Fe Energy Resources Inc. |
| Saxon Oil Co. | Acquired by | Hallwood Energy Corp. |
| Saxon Oil Development Partners | Acquired by | Hallwood Energy Partners L.P. |
| Strata Corp. | Name changed to | BT Energy Corp. |
| Texas International Co. | Name changed to | Phoenix Resource Co. |
| U.S. Mineral & Royalty Corp. | Name changed to | Habersham Energy Co. |

The following companies sold their U.S. oil and gas properties, or liquidated during the past year:

Calcasieu Real Estate & Oil Co.
Circle Seven Oil & Gas Inc.
Consolidated Energy Partners L.P.
Federated Natural Resources Corp.
General Energy Development Ltd.
ICG Petroleum Inc.
Reading and Bates
Transco Energy Co.
Transco Exploration Partners

* In addition to the above changes, 4 companies were taken private, 2 no longer file 10Ks, and 11 have no 1989 data available yet, asked to be excluded or cannot be located.

**Top companies in return on. . .***



* Includes subsidiary companies, whose accounting methods vary and who may be helped by contributions from parent companies. Excludes companies whose results were inflated by identifiable extraordinary gains. Excludes royalty trusts. Excludes companies who get only a small portion of their revenue from oil and gas. Numbers in parenthesis are rank by total assets.

OGJ

overproduction weakened prices again. The year's average was $12.58/bbl.

This year prices began at levels above those of first half 1989 but slid through most of the year. Exploration and drilling activity increased slightly nevertheless.

Prices leaped following Iraq's invasion of Kuwait Aug. 2. They seem likely to remain elevated for the last part of the year, which should give a modest boost to E&P activities. But companies remain wary of a price collapse after the dispute is settled.

There has been some optimism in the industry, with expectations of increasing demand for petroleum products and for natural gas.

Companies went through a major program of reorganization and restructuring the past several years. They have cut costs and are operating much more efficiently than before and seem well-positioned to take advantage of opportunities in the industry and to turn them into profits.

### Financial results

The OGJ 400 group's 8.6% profit decline in 1989 came despite a 6.1% gain in revenues to $459.2 billion.

Group net income is still well above levels of a few years ago. Profits of the OGJ group fell from $29.9 billion in 1982 to a low of $5.2 billion in 1986, the year crude prices collapsed. Profits recovered to $9.4 billion in 1987 and $22.3 billion in 1988. In 1986, only 116 of the 400 recorded profits. In 1989, 224 companies posted profits.

With the lower net income, group profitability indicators were slightly weaker in 1989 than in 1988. Return on assets slumped to 4.3% from 4.8% the year before. It was only 1% in 1986. The best year was 1982 at 5.7%.

Return on revenue slipped to 4.4%. This was down from the 5.1% of 1988—highest recorded for the OGJ400. This ratio had dropped to 1.2% in 1986.

Return on stockholders' equity dropped to 12.6% from 13.5% a year ago.

The high for this measure of performance was 13.8% in 1982; the low was 3% in

## Fastest growing companies*

[illegible]

* Companies were selected on the basis of growth in stockholders' equity. Only companies with positive net income for both 1988 and 1989 were considered. Companies were not considered if they had a decline in net income for 1989, were subsidiaries of another company, or became public within the last year.

1986.

With financial performance a bit weaker in 1989, the group reduced capital and exploration expenditures by 1.8% to $49.2 billion. Capital outlays for the OGJ400 group exceeded $65 billion/year in 1982-85.

The OGJ400 group changes from year to year, so comparisons are not for identical groups. However, the group does represent a large portion of the domestic oil and gas industry and, therefore, represents changes and trends in industry activity and operating performance.

### Highlights

Here are other highlights of the 1989 performance of this year's OGJ400:

- Total assets increased 0.3% to $469.8 billion. The $468.5 billion assets total for the 1989 OGJ400, reflecting 1988 data, was the lowest since the first OGJ400 report, which covered fiscal 1982.
- The group's revenue total of $459.2 billion was the highest since 1985, when it was $572.2 billion.
- Stockholders' equity fell 1.4% to $162 billion. Stockholders' equity peaked at $233.8 billion in 1983.
- Worldwide liquids production fell 6% in 1989 to 3.445 billion bbl. U.S. liquids production fell 7.3% to 2.145 billion bbl.
- Gas production moved up in 1989—worldwide by 4.1% to 14 tcf, U.S. by 2.1% to 10.3 tcf.
- Worldwide liquid reserves fell 5.4% to 34.6 billion bbl at yearend 1989. U.S. liquids reserves fell 2.2% to 22.4 billion bbl.
- Worldwide gas reserves dropped 3.5% to 166 tcf, and U.S. reserves fell 5.3% to 109.8 tcf.
- U.S. net wells drilled for the group was down 15.7% to 8,462 wells—the lowest number of wells drilled by the group since the OGJ400 report was first compiled.

## The top 20 in total revenue

| Rank | Company | Total revenue, $ million |
|---|---|---|
| 1 | Exxon Corp. | 86,286.0 |
| 2 | Mobil Corp. | 56,188.0 |
| 3 | Texaco Inc. | 35,656.0 |
| 4 | Chevron Corp. | 32,785.0 |
| 5 | Amoco Corp. | 26,760.0 |
| 6 | Shell Oil Co. | 21,948.0 |
| 7 | Occidental Petroleum Corp. | 20,068.0 |
| 8 | BP America | 17,885.0 |
| 9 | ARCO (Atlantic Richfield Corp.) | [illegible] |
| 10 | Conoco Inc. | 12,682.0 |
| 11 | Phillips Petroleum Co. | 12,[illegible]92.0 |
| 12 | USX (Oil & Gas segment) | 12,264.0 |
| 13 | Unocal Corp. | 11,353.0 |
| 14 | Enron Corp. | 9,835.7 |
| 15 | Ashland Oil Inc. | 8,590.0 |
| 16 | The Coastal Corp. | 8,349.6 |
| 17 | Amerada Hess Corp. | 5,679.3 |
| 18 | The Columbia Gas System Inc. | 3,204.4 |
| 19 | Kerr-McGee Corp. | 3,105.0 |
| 20 | American Petrofina Inc. | 3,057.6 |
| | Total | 414,805.5 |

### Group changes

The OGJ400 list reflects the industry's continued restructuring and consolidation.

This year's list has 51 new companies. It has 95 publicly held limited partnerships (LPs), compared with 71 last year and 63 the year before, and six royalty trusts, compared with seven last year.

It includes 25 companies that are subsidiaries of non-U.S. energy companies or of companies operating in another industry.

Publicly held LPs were first included in the OGJ400 in 1988. A number of drilling and income funds were converted to LPs in recent years for tax reasons. And a number of new LPs have been formed that are similar in function to income funds but are organized as limited partnerships. Many of these have been created by investment firms with experience in oil and gas financing as a way to acquire producing properties and sell interests publicly.

These firms have been included because they hold an increasing share of U.S. reserves and offer partnership units publicly.

The number of LPs may decline in future years. Some investment firms plan to consolidate assets of a number of their LPs into larger but fewer entities.

Mergers, consolidations, and other changes in reserves ownership continued throughout 1989 in a trend unlikely to reverse soon.

With crude prices now exceeding $30/bbl, however, producers may be more reluctant to sell reserves than they were before the Middle East crisis.

Lowest assets total on this year's OGJ400 list is $455,000—up from only $251,000 last year. This cutoff asset number has fluctuated from a low of $149,000 in 1986 to a high of $2.37 million in 1983.

Lowest asset total in the top 100 companies on this

### The top 20 in net income and stockholders' equity

| Rank | Company | Net income, $ million |
|---|---|---|
| 1 | [illegible] | 3,510.0 |
| 2 | [illegible] | 2,413.0 |
| 3 | [illegible] | 2,041.0 |
| 4 | [illegible] Richfield Corp.) | 1,953.0 |
| 5 | [illegible] | 1,809.0 |
| 6 | [illegible] | 1,610.0 |
| 7 | [illegible] | 1,405.0 |
| 8 | Conoco [illegible] | 538.0 |
| 9 | USX (Oil & Gas segment) | 534.0 |
| 10 | Amerada Hess Corp. | 476.3 |
| 11 | [illegible] Petroleum Corp. | 285.0 |
| 12 | [illegible] Corp. | 260.0 |
| 13 | [illegible] Exploration Partners Ltd. | 253.[illegible] |
| 14 | [illegible] Corp. | 251.0 |
| 15 | [illegible] Corp. | 226.3 |
| 16 | [illegible] Petroleum Co. | 219.0 |
| 17 | Union [illegible] Resources Co. | 200.4 |
| 18 | [illegible] Natural Gas Co. | 181.8 |
| 19 | Union [illegible] Petroleum Holdings, Inc. | 172.6 |
| 20 | The [illegible] Corp. | 170.1 |
|  | Total | 18,509.2 |

| Rank | Company | Stockholders' equity, $ million |
|---|---|---|
| 1 | Exxon Corp. | [illegible] |
| 2 | Mobil Corp. | [illegible] |
| 3 | Shell Oil Co. | 18,042.0 |
| 4 | Chevron Corp. | [illegible] |
| 5 | Amoco Corp. | 10,731.0 |
| 6 | Texaco Inc. | 8,160.0 |
| 7 | ARCO (Atlantic Richfield Corp.) | 6,592.0 |
| 8 | Occidental Petroleum Corp. | 5,693.9 |
| 9 | USX (Oil & Gas segment) | 4,621.0 |
| 10 | Amerada Hess Corp. | 2,580.5 |
| 11 | Unocal Corp. | 2,500.0 |
| 12 | Phillips Petroleum Co. | 2,132.0 |
| 13 | The Coastal Corp. | 1,793.0 |
| 14 | Enron Corp. | 1,765.9 |
| 15 | Consolidated Natural Gas Co. | 1,671.[illegible] |
| 16 | The Columbia Gas System Inc. | 1,622.3 |
| 17 | Oryx Energy Co. | 1,495.0 |
| 18 | Kerr-McGee Corp. | 1,474.6 |
| 19 | Pennzoil Co. | 1,282.0 |
| 20 | Ashland Oil Inc. | 1,140.8 |
|  | Total | 135,740.2 |

year's OGJ400 is $94.7 million, compared with $154 million last year.

The number of companies with net incomes exceeding $100 million totaled 28 this year and last, up from 21 in 1988. One hundred seventy-five companies posted net losses for 1989, but none had a loss of $100 million or more. In 1988, six companies lost more than $100 million.

#### The top 20

Concentration of assets in the top 20 companies of the OGJ400 increased slightly in 1989.

The top 20 companies ranked by assets had total assets of $390.3 billion in 1989, up 3.2% from the $378.3 billion a year earlier. This represented 83.1% of the total assets of the OGJ400, up from 80.75% of the assets on the 1989 list.

The biggest 20 companies on this year's list are the same as those last year, although there were some position changes. Consolidated Natural Gas Co. moved up to No. 19 from 20 last year, swapping places with Ashland Oil Inc. The only company that moved more than one position was BP America, which fell from No. 7 last year to 9 this year.

This top group reported revenues of $413.8 billion in 1989, 90.1% of the total for the OGJ400; net income of $18.2 billion, 89.6% of the total; and stockholders' equity of $132.8 billion, 82% of the total.

Capital and exploration expenditures by the top 20 group in 1989 amounted to $40.1 billion, 81.5% of OGJ400 spending. The group drilled 4,996 net wells in 1989, 59% of all the wells drilled by the OGJ400 group.

Production and reserves statistics for the OGJ400 also were dominated by the top 20 companies, which accounted for 89.1% of the total group's worldwide liquids production, 87.7% of U.S. liquids production, 74.5% of worldwide natural gas production, and 69% of U.S. gas production.

With respect to future production potential, the largest 20 companies hold 90% of the OGJ400 group's worldwide liquids reserves and 87.7% of U.S. liquids reserves. They also have 74.5% of the worldwide natural gas reserves and 71% of the U.S. gas reserves.

#### OGJ400's share

The OGJ400 group's total revenue of $459.2 billion in 1989 represented 8.8% of U.S. gross national product. This was down from 8.9% the year before.

The group's revenues reached a peak of 18.4% of GNP in 1983.

The OGJ400 companies' 1989 liquids production was 65.5% of the U.S. total. Their natural gas production was 57.6% of the total. They hold 65.5% of total U.S. liquids reserves and 65.7% of U.S. natural gas reserves.

The group holds 3.5% of worldwide liquids reserves and 3.6% of natural gas reserves. In 1989 it represent-

### The top 20 in spending and U.S. net wells drilled

| Rank | Company | Capital, exploratory spending, $ million |
|---|---|---|
| 1 | Exxon Corp. | 11,784.0 |
| 2 | Mobil Corp. | 3,383.0 |
| 3 | Chevron Corp. | 3,067.0 |
| 4 | Amoco Corp. | 2,843.0 |
| 5 | Shell Oil Co. | 2,433.0 |
| 6 | Texaco Inc. | 2,313.0 |
| 7 | ARCO (Atlantic Richfield Corp.) | 2,105.0 |
| 8 | BP America | 2,032.0 |
| 9 | Amerada Hess Corp. | 1,561.4 |
| 10 | Conoco Inc. | 1,556.0 |
| 11 | Occidental Petroleum Corp. | 1,532.0 |
| 12 | USX (Oil & Gas Segment) | 1,199.0 |
| 13 | Unocal Corp. | 1,050.0 |
| 14 | Phillips Petroleum Co. | 872.0 |
| 15 | Oryx Energy Co. | 822.0 |
| 16 | Freeport-McMoRan Co. Inc. | 461.9 |
| 17 | Consolidated Natural Gas Co. | 443.2 |
| 18 | Kerr-McGee Corp. | 437.0 |
| 19 | The Columbia Gas System Inc. | 435.0 |
| 20 | The Coastal Corp. | 427.9 |
|  | Total | 40,067.4 |

| Rank | Company | U.S. net wells drilled |
|---|---|---|
| 1 | Mobil Corp. | 611.0 |
| 2 | Shell Oil Co. | 542.0 |
| 3 | Exxon Corp. | 451.0 |
| 4 | USX (Oil & Gas segment) | 425.0 |
| 5 | ARCO (Atlantic Richfield Corp.) | 417.0 |
| 6 | Texaco Inc. | 406.0 |
| 7 | Amoco Corp. | 375.0 |
| 8 | Chevron Corp. | 253.0 |
| 9 | Consolidated Natural Gas Co. | 255.0 |
| 10 | Union Pacific Resources Co. | 228.0 |
| 11 | Oryx Energy Co. | 224.0 |
| 12 | Unocal Corp. | 223.0 |
| 13 | Anadarko Petroleum Corp. | 192.8 |
| 14 | Pacific Enterprises Oil & Gas Co. | 188.7 |
| 15 | Equitable Resources Inc. | 184.5 |
| 16 | Cabot Corp. | 172.4 |
| 17 | Conoco Inc. | 167.6 |
| 18 | Enron Corp. | 157.4 |
| 19 | Pennzoil Co. | 153.2 |
| 20 | Occidental Petroleum Corp. | 149.7 |
|  | Total | 5,784.2 |

## The top 20 in liquids reserves

| Rank | Company | U.S. liquids reserves, million bbl |
|---|---|---|
| 1 | Shell Oil Co. | 2,861.0 |
| 2 | ARCO (Atlantic Richfield Co.) | 2,765.0 |
| 3 | BP America | 2,579.0 |
| 4 | Exxon Corp. | 2,487.0 |
| 5 | Chevron Corp. | 1,763.0 |
| 6 | Amoco Corp. | 1,686.0 |
| 7 | Texaco Inc. | 1,565.0 |
| 8 | Mobil Corp. | 1,202.0 |
| 9 | Unocal Corp. | 636.0 |
| 10 | USX (Oil & Gas segment) | 586.0 |
| 11 | Oryx Energy Co. | 571.0 |
| 12 | Conoco Inc. | 477.0 |
| 13 | Phillips Petroleum Co. | 459.0 |
| 14 | Santa Fe Energy Resources, Inc. | 219.8 |
| 15 | Union Exploration Partners Ltd. | 218.0 |
| 16 | Amerada Hess Corp. | 203.0 |
| 17 | Occidental Petroleum Corp. | 191.0 |
| 18 | Union Pacific Resources Co. | 150.3 |
| 19 | Pennzoil Co. | 128.0 |
| 20 | Mitchell Energy & Development Corp. | 88.5 |
|  | **Total** | **20,835.6** |

| Rank | Company | Worldwide liquids reserves, million bbl |
|---|---|---|
| 1 | Exxon Corp. | 6,585.0 |
| 2 | Shell Oil Co. | 3,080.0 |
| 3 | ARCO (Atlantic Richfield Co.) | 3,002.0 |
| 4 | Chevron Corp. | 2,854.0 |
| 5 | Amoco Corp. | 2,746.0 |
| 6 | BP America | 2,655.0 |
| 7 | Mobil Corp. | 2,604.0 |
| 8 | Texaco Inc. | 2,294.0 |
| 9 | Conoco Inc.. | 1,105.0 |
| 10 | Phillips Petroleum Co. | 991.0 |
| 11 | Unocal Corp. | 909.0 |
| 12 | USX (Oil & Gas Segment) | 764.0 |
| 13 | Occidental Petroleum Corp. | 750.0 |
| 14 | Oryx Energy Co. | 571.0 |
| 15 | Amerada Hess Corp. | 570.0 |
| 16 | Santa Fe Energy Resources, Inc. | 219.8 |
| 17 | Union Exploration Partners Ltd. | 218.0 |
| 18 | Maxus Energy Corp. | 192.7 |
| 19 | Union Pacific Resources Co. | 150.3 |
| 20 | Union Texas Petroleum Holdings, Inc. | 131.0 |
|  | **Total** | **32,391.8** |

## The top 20 in liquids production

| Rank | Company | U.S. liquids production, million bbl |
|---|---|---|
| 1 | BP America | 286.0 |
| 2 | Exxon Corp. | 253.1 |
| 3 | ARCO (Atlantic Richfield Corp.) | 241.0 |
| 4 | Shell Oil Inc. | 180.0 |
| 5 | Chevron Corp. | 176.0 |
| 6 | Texaco Inc. | 175.0 |
| 7 | Amoco Corp. | 142.0 |
| 8 | Mobil Corp. | 107.0 |
| 9 | Unocal Corp. | 63.0 |
| 10 | Oryx Energy Co. | 53.0 |
| 11 | USX (Oil & Gas segment) | 52.3 |
| 12 | Phillips Petroleum Co. | 48.0 |
| 13 | Conoco Inc. | 41.0 |
| 14 | Amerada Hess Corp. | 26.0 |
| 15 | Occidental Petroleum Corp. | 24.0 |
| 16 | Union Pacific Resources Co. | 23.3 |
| 17 | Santa Fe Energy Resources, Inc. | 18.5 |
| 18 | Union Exploration Partners Ltd. | 18.0 |
| 19 | Mitchell Energy & Development Corp. | 14.3 |
| 20 | Pennzoil Co. | 10.0 |
|  | **Total** | **1,951.4** |

| Rank | Company | Worldwide liquids production, million bbl |
|---|---|---|
| 1 | Exxon Corp. | 621.0 |
| 2 | Chevron Corp. | 312.0 |
| 3 | Amoco Corp. | 296.0 |
| 4 | BP America | 287.0 |
| 5 | Texaco Inc. | 269.0 |
| 6 | ARCO (Atlantic Richfield Corp.) | 267.0 |
| 7 | Mobil Corp. | 249.0 |
| 8 | Shell Oil Co. | 209.0 |
| 9 | Conoco Inc. | 129.0 |
| 10 | Unocal Corp. | 95.0 |
| 11 | Phillips Petroleum Co. | 94.0 |
| 12 | USX Corp. (Oil & Gas segment) | 76.1 |
| 13 | Occidental Petroleum Corp. | 72.0 |
| 14 | Amerada Hess Corp. | 56.0 |
| 15 | Oryx Energy Co. | 53.0 |
| 16 | Union Pacific Resources Co. | 23.3 |
| 17 | Maxus Energy Corp. | 20.8 |
| 18 | Santa Fe Energy Resources, Inc. | 18.5 |
| 19 | Union Exploration Partners Ltd. | 18.0 |
| 20 | Kerr-McGee Corp. | 16.7 |
|  | **Total** | **3,182.4** |

## The top 20 in gas reserves

| Rank | Company | U.S. gas reserves, bcf |
|---|---|---|
| 1 | Amoco Corp. | 12,254.0 |
| 2 | Exxon Corp. | 9,365.0 |
| 3 | Chevron Corp. | 7,739.0 |
| 4 | Mobil Corp. | 7,347.0 |
| 5 | ARCO (Atlantic Richfield Corp.) | 6,452.0 |
| 6 | Shell Oil Co. | 6,223.0 |
| 7 | Texaco Inc. | 4,834.0 |
| 8 | Unocal Corp. | 4,130.0 |
| 9 | Phillips Petroleum Co. | 3,585.0 |
| 10 | USX Corp. (Oil & Gas segment) | 2,792.0 |
| 11 | Occidental Petroleum Corp. | 2,489.0 |
| 12 | Union Exploration Partners Ltd. | 2,425.0 |
| 13 | Conoco Inc. | 2,232.0 |
| 14 | BP America | 2,171.0 |
| 15 | Oryx Energy Co. | 2,146.0 |
| 16 | Mesa L.P. | 2,110.2 |
| 17 | Anadarko Petroleum Corp. | 1,670.6 |
| 18 | Union Pacific Resources Co. | 1,579.9 |
| 19 | Enron Corp. | 1,311.6 |
| 20 | Ensearch Corp. | 1,222.3 |
|  | **Total** | **84,078.6** |

| Rank | Company | Worldwide gas reserves, bcf |
|---|---|---|
| 1 | Exxon Corp | 26,056.0 |
| 2 | Mobil Corp. | 19,376.0 |
| 3 | Amoco Corp. | 18,860.0 |
| 4 | Chevron Corp. | 10,030.0 |
| 5 | ARCO (Atlantic Richfield Corp.) | 7,658.0 |
| 6 | Shell Oil Co. | 6,598.0 |
| 7 | Unocal Corp. | 6,186.0 |
| 8 | Texaco Inc. | 5,841.0 |
| 9 | Phillips Petroleum Co. | 5,470.0 |
| 10 | USX (Oil & Gas segment) | 4,456.0 |
| 11 | BP America | 3,856.0 |
| 12 | Conoco inc. | 3,678.0 |
| 13 | Occidental Petroleum Corp. | 2,876.0 |
| 14 | Union Exploration Partners Ltd. | 2,425.0 |
| 15 | Amerada Hess Corp. | 2,378.0 |
| 16 | Oryx Energy Co. | 2,146.0 |
| 17 | Mesa L.P. | 2,110.2 |
| 18 | Anadarko Petroleum Corp. | 1,729.0 |
| 19 | Union Pacific Resources Co. | 1,579.9 |
| 20 | Union Texas Petroleum Holdings, Inc. | 1,507.7 |
|  | **Total** | **134,815.9** |

## The top 20 in gas production

| Rank | Company | U.S. gas production, bcf |
|---|---|---|
| 1 | Chevron Corp. | 881.0 |
| 2 | Exxon Corp. | 744.0 |
| 3 | Texaco Inc. | 729.0 |
| 4 | Amoco Corp. | 710.0 |
| 5 | Mobil Corp. | 644.0 |
| 6 | ARCO (Atlantic Richfield Corp.) | 558.0 |
| 7 | Shell Oil Co. | 582.0 |
| 8 | USX (Oil & Gas segment) | 533.2 |
| 9 | Phillips Petroleum Co. | 321.0 |
| 10 | Unocal Corp. | 304.0 |
| 11 | Conoco Inc. | 274.0 |
| 12 | Oryx Energy Co. | 270.0 |
| 13 | Occidental Petroleum Corp. | 264.0 |
| 14 | Union Exploration Partners Ltd. | 169.0 |
| 15 | Union Pacific Resources Co. | 153.2 |
| 16 | Consolidated Natural Gas Co. | 147.5 |
| 17 | Anadarko Petroleum Corp. | 141.1 |
| 18 | Mesa L.P. | 137.2 |
| 19 | Pennzoil Co. | 135.0 |
| 20 | BP America | 129.0 |
| | Total | 7,874.2 |

| Rank | Company | World gas production, bcf |
|---|---|---|
| 1 | Mobil Corp. | [illegible] |
| 2 | Exxon Corp. | [illegible] |
| 3 | Amoco Corp. | [illegible] |
| 4 | Chevron Corp. | [illegible] |
| 5 | Texaco Inc. | 803.0 |
| 6 | ARCO (Atlantic Richfield Corp.) | 690.0 |
| 7 | Shell Oil Co. | [illegible] |
| 8 | Unocal Corp. | 461.0 |
| 9 | USX Corp. (Oil & Gas segment) | 409.1 |
| 10 | Phillips Petroleum Co. | 405.0 |
| 11 | Conoco Inc. | 357.0 |
| 12 | Occidental Petroleum Corp. | [illegible] |
| 13 | Oryx Energy Co. | 270.0 |
| 14 | Amerada Hess Corp. | 204.0 |
| 15 | Union Exploration Partners Ltd. | 169.0 |
| 16 | Union Texas Petroleum Holdings, Inc. | [illegible] |
| 17 | BP America | 160.0 |
| 18 | Union Pacific Resources Co. | 153.2 |
| 19 | Consolidated Natural Gas Co. | 147.5 |
| 20 | Anadarko Petroleum Corp. | 141.1 |
| | Total | 10,071.8 |

ed 14.8% of worldwide liquids production and 19.6% of natural gas production.

### Fast growers

Rankings on the list of fastest growing companies are based on growth in stockholders' equity and include only companies with positive net income for 1989 and 1988 and income growth in 1989. Subsidiary companies, newly public companies, and LPs are not included.

Most of the 20 fast-growth companies posted substantial increases in net income in 1989. Twelve had increases of 100% or more.

The long term debt positions of the companies on the list were mixed. Ten of the companies decreased long term debt, seven increased long term debt, and three were unchanged with no long term debt. None of the companies had large increases in long term debt.

Nucorp Inc. led the growth list this year. Its stockholders' equity moved up 186%, and net income increased 322% to $725,000 in 1989.

Eight of the companies were on the fast-growth list last year. Three of them have appeared on the list for 3 straight years—Swift Energy Co., Plains Petroleum Co., and Coastal Corp. Union Texas Petroleum Holdings, Brock Exploration Corp., Belcor Inc., Whiting Petroleum Corp., and Arch Petroleum Inc. made it for the second year in a row.

### The OGJ100

The OGJ100, a companion list, includes financial and operational data for non-U.S. companies.

Many of the state owned oil and gas companies report only production and reserves information and do not report financial data. Therefore, the companies are not ranked by assets or revenues but instead are listed by region based on the location of corporate headquarters.

The top 20 OGJ100 companies in crude oil production and reserves are dominated by state companies in major producing countries. The leading nongovernment company in both reserves and production is Royal Dutch-/Shell Group. It ranks No. 11 in the world in liquids reserves and 6 in liquids production.

Reserves of the top 20 companies increased by 139.3 billion bbl to 853.8 billion bbl. The top 20 companies now control 85.2% of the world's proved oil reserves, up from 78.7% last year.

The major U.S. international oil companies headquartered in the U.S. are not included in the OGJ100, but several of the companies would rank in the top 20.

Exxon Corp. would rank No. 7 in worldwide liquids production and 14 in worldwide liquids reserves.

Other U.S. companies that would make the list of top liquids producers are Chevron Corp. No. 14, Amoco Corp. 15, Texaco Inc. 16, Arco 17, and Mobil Corp. 20.

However, no other company on the OGJ400 list would make the worldwide list of top 20 companies in terms of liquids reserves. ▪

## OGJ100: reserves and production leaders

| Rank | Company | Reserves, million bbl |
|---|---|---|
| 1 | Saudi Arabian Oil Co. | 254,959.0 |
| 2 | Iraq National Oil Co. | 100,000.0 |
| 3 | Kuwait Petroleum Corp. | 94,525.0 |
| 4 | National Iranian Oil Co. | 92,850.0 |
| 5 | Abu Dhabi National Oil Co. | 92,205.0 |
| 6 | Petroleos de Venezuela SA | 59,041.0 |
| 7 | Petroleos Mexicanos | 51,983.0 |
| 8 | National Oil Corp. (Libya) | 22,800.0 |
| 9 | Nigerian National Petrol. Corp. | 16,000.0 |
| 10 | Pertamina (Indonesia) | 11,055.0 |
| 11 | Royal Dutch/Shell (Netherlands) | 9,496.0 |
| 12 | Sonatrach (Algeria) | 9,200.0 |
| 13 | Oil & Natural Gas Commission (India) | 7,516.4 |
| 14 | China National Offshore Oil Corp. | 6,335.9 |
| 15 | Ente Nazionale Idrocarburi (Italy) | 5,156.0 |
| 16 | British Petroleum Co. plc (U.K.) | 4,922.0 |
| 17 | Qatar General Petrol. Corp. | 4,500.0 |
| 18 | Petroleum Development Oman | 4,250.0 |
| 19 | Dubai Petroleum Co. | 4,000.0 |
| 20 | Petronas (Malaysia) | 2,950.0 |
| | Total | 853,738.3 |

| Rank | Company | Production, million bbl |
|---|---|---|
| 1 | Saudi Arabian Oil Co. | 1,323.2 |
| 2 | National Iranian Oil Co. | 1,075.7 |
| 3 | Iraq National Oil Co. | 1,031.4 |
| 4 | Petroleos Mexicanos | 917.4 |
| 5 | Petroleos de Venezuela SA | 855.5 |
| 6 | Royal Dutch/Shell (Netherlands) | 673.0 |
| 7 | Nigerian National Petrol. Corp. | 610.3 |
| 8 | Kuwait Petroleum Corp. | 581.4 |
| 9 | Abu Dhabi National Oil Co. | 535.6 |
| 10 | British Petroleum Co. plc (U.K.) | 515.6 |
| 11 | Pertamina (Indonesia) | 514.3 |
| 12 | National Oil Corp. (Libya) | 412.8 |
| 13 | Sonatrach (Algeria) | 280.6 |
| 14 | Ste. Nat. Elf Aquitaine (France) | 259.7 |
| 15 | Oil & Natural Gas Commission (India) | 245.7 |
| 16 | Petroleo Brasileiro SA (Brazil) | 225.1 |
| 17 | Petroleum Development Oman | 223.7 |
| 18 | Petronas (Malaysia) | 208.5 |
| 19 | Yacimientos Petroliferos Fiscales SA (Argentina) | 187.2 |
| 20 | Ente Nazionale Idrocarburi (Italy) | 157.6 |
| | Total | [illegible] |

| Rank by total — assets — 1989 | 1988 | Company | Total assets $000 | — Total revenue — Rank | $000 | — Net income — Rank | $000 | —— Stockholders' equity —— Rank | $000 | — Capital & Expl. spending — Rank | $000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Exxon Corp. | 83,219,000 | 1 | 96,285,000 | 1 | 3,510,000 | 1 | 30,244,000 | 1 | 11,784,000 |
| 2 | 2 | Mobil Corp. | 39,080,000 | 2 | 56,188,000 | 5 | 1,809,000 | 2 | 16,274,000 | 2 | 3,393,000 |
| 3 | 3 | Chevron Corp. | 33,884,000 | 4 | 32,785,000 | 14 | 251,000 | 4 | 13,980,000 | 3 | 3,067,000 |
| 4 | 4 | Amoco Corp. | 30,430,000 | 5 | 26,760,000 | 6 | 1,610.000 | 5 | 13,684,000 | 4 | 2,643,000 |
| 5 | 5 | Shell Oil Co.[1] | 27,590,000 | 6 | 21,948,000 | 7 | 1,405,000 | 3 | 16,049,000 | 5 | 2,433,000 |
| 6 | 6 | Texaco Inc. | 25,636,000 | 3 | 35,656,000 | 2 | 2,413,000 | 6 | 9,180,000 | 6 | 2,313,000 |
| 7 | 8 | ARCO (Atlantic Richfield Corp.) | 22,261,000 | 9 | 16,815,000 | 4 | 1,953,000 | 7 | 6,562,000 | 7 | 2,105,000 |
| 8 | 9 | Occidental Petroleum Corp. | 20,741,000 | 7 | 20,068,000 | 11 | 285,000 | 8 | 5,899,000 | 11 | 1,532,000 |
| 9 | 7 | BP America[2] | 20,438,000 | 8 | 17,688,000 | 3 | [3]2,041,000 | — | NA | 8 | 2,032,0[illegible]0 |
| 10 | 11 | USX (Oil & Gas segment)[4] | 11,529,000 | 12 | 12,264,000 | 9 | 534,000 | 9 | 4,621,000 | 12 | 1,199,[illegible]0 |
| 11 | 10 | Phillips Petroleum Co. | 11,256,000 | 11 | 12,492,000 | 16 | 219,000 | 12 | 2,132,000 | 14 | 872,000 |
| 12 | 12 | Conoco Inc.[5] | 10,392,000 | 10 | 12,682,000 | 8 | [6]538,000 | — | NA | 10 | 1,556,000 |
| 13 | 13 | Unocal Corp. | 9,257,000 | 13 | 11,353,000 | 12 | 260,000 | 11 | 2,300,000 | 13 | 1,050,000 |
| 14 | 14 | Enron Corp. | 9,104,803 | 14 | 9,835,656 | 15 | 226,334 | 14 | 1,785,851 | 22 | 421,738 |
| 15 | 15 | The Coastal Corp. | 8,773,300 | 16 | 8,349,500 | 20 | 170,100 | 13 | 1,793,000 | 20 | 427,900 |
| 16 | 17 | Amerada Hess Corp. | 6,867,411 | 17 | 5,679,327 | 10 | 476,349 | 10 | 2,560,628 | 9 | 1,561,433 |
| 17 | 16 | The Columbia Gas System Inc. | 5,878,400 | 18 | 3,204,400 | 23 | 145,800 | 16 | 1,620,300 | 19 | 435,000 |
| 18 | 18 | Pennzoil Co. | 4,881,977 | 23 | 2,329,823 | 28 | 103,547 | 19 | 1,281,980 | 25 | 379,529 |
| 19 | 20 | Consolidated Natural Gas Co. | 4,601,245 | 21 | 2,806,052 | 18 | 181,774 | 15 | 1,671,898 | 17 | 443,200 |
| 20 | 19 | Ashland Oil Inc.[10] | 4,455,743 | 15 | 8,589,986 | 29 | 86,205 | 20 | 1,140,524 | 23 | 421,340 |
| 21 | 21 | Oryx Energy Co. | 4,185,000 | 31 | 1,211,000 | 24 | 139,000 | 17 | 1,485,000 | 15 | 622,000 |
| 22 | 24 | Arkla, Inc. | 3,886,314 | 24 | 2,245,662 | 399 | (84,264) | 30 | 709,883 | 24 | 397,237 |
| 23 | 22 | Freeport-McMoRan Inc. | 3,560,909 | 25 | 1,958,196 | 22 | 149,855 | 45 | 390,972 | 16 | 461,876 |
| 24 | 26 | Kerr-McGee Corp. | 3,332,000 | 19 | 3,105,000 | 21 | 156,000 | 18 | 1,476,000 | 18 | 437,000 |
| 25 | 28 | Enserch Corp. | 3,254,246 | 22 | 2,741,819 | 32 | 73,352 | 26 | 876,328 | 35 | 186,938 |
| 26 | 25 | Sonat Inc. | 3,083,711 | 27 | 1,778,461 | 27 | 108,978 | 21 | 1,123,000 | 21 | 426,292 |
| 27 | 27 | Mesa L.P. | 2,625,623 | 50 | 380,161 | 398 | (63,023) | 33 | [11]610,293 | 60 | 60,928 |
| 28 | 30 | American Petrofina Inc.[12] | 2,505,297 | 20 | 3,057,646 | 26 | 119,143 | 22 | 1,060,729 | 30 | 234,406 |
| 29 | 31 | NICOR Inc. | 2,136,700 | 29 | 1,646,700 | 25 | 119,900 | 31 | 654,800 | 39 | 150,000 |
| 30 | 33 | Mitchell Energy & Development Corp.[33] | 2,099,360 | 44 | 658,032 | 48 | 30,449 | 34 | 582,258 | 34 | 195,650 |
| 31 | 32 | Murphy Oil Corp. | 2,074,818 | 28 | 1,683,716 | 39 | 46,551 | 29 | 769,578 | 29 | 248,530 |
| 32 | 34 | The Montana Power Co. | 1,945,952 | 40 | 737,395 | 31 | 74,411 | 27 | 794,346 | 43 | 118,286 |
| 33 | 35 | Union Pacific Resources Co.[15] | 1,846,700 | 34 | 896,800 | 17 | 200,400 | 23 | 989,500 | 26 | 304,000 |
| 34 | 37 | Union Texas Petroleum Holdings, Inc. | 1,720,620 | 32 | 1,159,739 | 19 | 172,584 | 52 | 275,340 | 27 | 294,763 |
| 35 | 39 | Union Exploration Partners Ltd.[16] | 1,605,300 | 39 | 753,200 | 13 | 253,700 | 24 | [11]885,400 | 28 | 248,800 |
| 36 | 40 | Anadarko Petroleum Corp. | 1,553,152 | 51 | 363,649 | 38 | 48,004 | 38 | 495,261 | 33 | 202,870 |
| 37 | 36 | Maxus Energy Corp. | 1,477,800 | 42 | 666,400 | 392 | (31,000) | 393 | (56,700 | 37 | 165,800 |
| 38 | 38 | Cabot Corp.[10] | 1,417,399 | 26 | 1,943,652 | 59 | 18,057 | 39 | 489,182 | 31 | 213,005 |
| 39 | 43 | National Fuel Gas Co.[10] | 1,311,635 | 35 | 861,925 | 33 | 52,420 | 40 | 464,228 | 42 | 129,613 |
| 40 | 42 | Freeport McMoRan Energy Partners [17] | 1,284,836 | 57 | 254,835 | 40 | 45,664 | 25 | [11]877,962 | 40 | 145,312 |
| 41 | 41 | Louisiana Land & Exploration Co. | 1,199,400 | 38 | 757,000 | 41 | 44,100 | 44 | 416,200 | 32 | 207,500 |
| 42 | 46 | Equitable Resources Inc. | 1,138,949 | 47 | 513,773 | 35 | 50,874 | 37 | 503,790 | 53 | 89,165 |
| 43 | 45 | Pacific Enterprises Oil & Gas Co.[18] | 1,100,000 | 55 | 296,000 | 34 | 51,000 | 36 | 551,000 | 38 | 165,000 |
| 44 | 44 | BHP Petroleum (Americas) Inc.[19,20] | 1,078,450 | 60 | 236,269 | 389 | (18,573) | 32 | 639,809 | 44 | 117,328 |
| 45 | 47 | Questar Corp.[21] | 1,075,045 | 46 | 516,404 | 36 | 50,757 | 41 | 455,823 | 51 | 92,215 |
| 46 | 50 | Enserch Exploration Partners Ltd.[22] | 1,041,266 | 62 | 223,870 | 43 | 42,720 | 28 | [11]782,278 | 47 | 109,141 |
| 47 | 48 | Ocean Drilling & Exploration Co. | 956,321 | 54 | 320,672 | 390 | (29,592) | 46 | 382,781 | 52 | 91,907 |
| 48 | 51 | ONEOK Inc.[23] | 923,195 | 45 | 647,743 | 45 | 36,640 | 48 | 342,825 | 68 | 46,102 |
| 49 | 49 | Santa Fe Energy Resources, Inc.[24] | 881,800 | 52 | 345,900 | 37 | 49,800 | 55 | 228,100 | 50 | 95,900 |
| 50 | 53 | Grace Energy Corp.[25] | 811,169 | 49 | 392,714 | 53 | 23,419 | 35 | 555,378 | 45 | 114,800 |
| 51 | 56 | Diversified Energies, Inc. | 806,996 | 36 | 843,476 | 51 | 25,278 | 53 | 255,718 | 56 | 76,086 |

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 1 | 621.0 | 2 | 1,574.0 | 1 | 6,585.0 | 1 | 26,056.0 | 2 | 253.0 | 2 | 744.0 | 4 | 2,487.0 | 2 | 9,365.0 | 3 | 451.0 |
| 7 | 249.0 | 1 | 1,598.0 | 7 | 2,604.0 | 2 | 19,376.0 | 8 | 107.0 | 5 | 644.0 | 8 | 1,202.0 | 4 | 7,347.0 | 1 | 611.0 |
| 2 | 312.0 | 4 | 989.0 | 4 | 2,854.0 | 4 | 10,030.0 | 5 | 176.0 | 1 | 881.0 | 5 | 1,763.0 | 3 | 7,739.0 | 8 | 253.0 |
| 3 | 296.0 | 3 | 1,278.0 | 5 | 2,746.0 | 3 | 18,860.0 | 7 | 142.0 | 4 | 710.0 | 6 | 1,686.0 | 1 | 12,254.0 | 7 | 375.0 |
| 8 | 209.0 | 7 | 542.0 | 2 | 3,080.0 | 6 | 6,598.0 | 4 | 180.0 | 7 | 532.0 | 1 | 2,861.0 | 6 | 6,223.0 | 2 | 542.0 |
| 5 | 269.0 | 5 | 803.0 | 8 | 2,294.0 | 8 | 5,841.0 | 6 | 175.0 | 3 | 729.0 | 7 | 1,565.0 | 7 | 4,834.0 | 6 | 406.0 |
| 6 | 267.0 | 6 | 620.0 | 3 | 3,002.0 | 5 | 7,658.0 | 3 | 241.0 | 6 | 558.0 | 2 | 2,765.0 | 5 | 6,452.0 | 5 | 417.0 |
| 13 | 72.00 | 12 | 283.0 | 13 | 750.0 | 13 | 2,876.0 | 15 | 24.00 | 13 | 264.0 | 17 | 191.0 | 11 | 2,489.0 | 20 | 149.7 |
| 4 | 287.0 | 17 | 159.0 | 6 | 2,655.0 | 11 | 3,856.0 | 1 | 286.0 | 20 | 129.0 | 3 | 2,579.0 | 14 | 2,171.0 | — | NA |
| 12 | 76.12 | 9 | 469.1 | 12 | 764.0 | 10 | 4,456.0 | 11 | 52.34 | 8 | 333.2 | 10 | 586.0 | 10 | 2,792.0 | 4 | 425.0 |
| 11 | 94.00 | 10 | 468.0 | 10 | 991.0 | 9 | 5,470.0 | 12 | 48.00 | 9 | 321.0 | 13 | 459.0 | 9 | 3,585.0 | 21 | 134.0 |
| 9 | 129.0 | 11 | 397.0 | 9 | 1,105.0 | 12 | 3,678.0 | 13 | 41.00 | 11 | 274.0 | 12 | 477.0 | 13 | 2,232.0 | 17 | 167.5 |
| 10 | 95.00 | 8 | 481.0 | 11 | 909.0 | 7 | 6,186.0 | 9 | 63.00 | 10 | 304.0 | 9 | 636.0 | 8 | 4,130.0 | 12 | 223.0 |
| 41 | 3.190 | 23 | 129.5 | 44 | 24.16 | 21 | 1,415.6 | 45 | 2.247 | 21 | 123.3 | 46 | 17.65 | 19 | 1,311.6 | 18 | [7]167.4 |
| 38 | 3.425 | 25 | [8]95.26 | 43 | 25.02 | 25 | [8]953.9 | 35 | 3.425 | 24 | [8]95.26 | 36 | 25.02 | 24 | [8]953.9 | 40 | 48.20 |
| 14 | 56.00 | 14 | 204.0 | 15 | 570.0 | 15 | 2,378.0 | 14 | 26.00 | 22 | 122.0 | 16 | 203.0 | 23 | 1,050.0 | 47 | 34.00 |
| 53 | 1.924 | 32 | 77.70 | 54 | 16.73 | 28 | 902.7 | 59 | 1.310 | 29 | 75.10 | 57 | 11.97 | 26 | 791.0 | 29 | 74.00 |
| 26 | 10.00 | 22 | 135.0 | 21 | 130.0 | 27 | 920.0 | 20 | 10.00 | 19 | 133.0 | 19 | 128.0 | 25 | 872.0 | 19 | 158.2 |
| 33 | [9]5.981 | 19 | [9]147.5 | 35 | [9]43.29 | 23 | [9]1,212.0 | 28 | [9]5.981 | 16 | [9]147.5 | 30 | [9]38.52 | 21 | [9]1,211.0 | 9 | 250.0 |
| 24 | 13.00 | 69 | 15.60 | 34 | 43.50 | 60 | 232.3 | 77 | 0.800 | 61 | 15.60 | 119 | 2.500 | 55 | 232.3 | 23 | 110.0 |
| 15 | 53.00 | 13 | 270.0 | 14 | 571.0 | 16 | 2,146.0 | 10 | 53.00 | 12 | 270.0 | 11 | 571.0 | 15 | 2,146.0 | 11 | 224.0 |
| 101 | 0.543 | 42 | 53.16 | 82 | 6.529 | 31 | 762.6 | 92 | 0.543 | 39 | 53.16 | 76 | 6.529 | 27 | 762.6 | 37 | 58.64 |
| 29 | 7.307 | 27 | 88.80 | 27 | 68.54 | 32 | 749.1 | 25 | 6.480 | 31 | 69.80 | 22 | 68.54 | 28 | 749.1 | 27 | 76.20 |
| 20 | 16.70 | 26 | 91.00 | 22 | 117.0 | 30 | 794.0 | 24 | 7.800 | 26 | 81.50 | 29 | 41.20 | 34 | 607.1 | 39 | 54.38 |
| 40 | 3.209 | 36 | 68.84 | 41 | 28.06 | 22 | 1,229.8 | 39 | 2.939 | 33 | 68.84 | 33 | 25.94 | 20 | 1,222.3 | 59 | 18.00 |
| 48 | 2.646 | 37 | 63.00 | 61 | 13.50 | 40 | 582.5 | 42 | 2.646 | 35 | 63.00 | 53 | 13.50 | 35 | 582.5 | 33 | 64.25 |
| 32 | 6.210 | 21 | 137.2 | 25 | 86.60 | 17 | 2,110.2 | 27 | [7]6.210 | 18 | [7]137.2 | 21 | [7]86.60 | 16 | [7]2,110.2 | 24 | 93.00 |
| 28 | 8.168 | 34 | 72.07 | 32 | 55.76 | 36 | 670.6 | 23 | 8.168 | 30 | 72.07 | 26 | 55.76 | 31 | 670.6 | 25 | 88.00 |
| 71 | 1.000 | 56 | 22.00 | 100 | 4.600 | 74 | 122.6 | 66 | 1.000 | 54 | 22.00 | 92 | 4.600 | 66 | 122.6 | 75 | 11.20 |
| 23 | 14.30 | 39 | 55.30 | 23 | 88.50 | 41 | 562.0 | 19 | 14.30 | 37 | 55.30 | 20 | 88.50 | 36 | 562.0 | 30 | 73.40 |
| 21 | 16.10 | 28 | 86.30 | 24 | 87.20 | 38 | 648.1 | 29 | 5.400 | 34 | 66.80 | 35 | 25.10 | 112 | 37.40 | 54 | 21.30 |
| 82 | 0.798 | 60 | 21.45 | 85 | 5.893 | 45 | [14]385.4 | 102 | 0.439 | 74 | 10.43 | 118 | 2.546 | 61 | 143.3 | 101 | 5.000 |
| 16 | 23.30 | 18 | 153.2 | 19 | 150.3 | 19 | 1,579.9 | 16 | 23.30 | 15 | 153.2 | 18 | 150.3 | 18 | 1,579.9 | 10 | 226.0 |
| 27 | 9.399 | 16 | 163.1 | 20 | 131.0 | 20 | 1,507.7 | 32 | 3.533 | 27 | 78.46 | 34 | 25.17 | 41 | 399.5 | 41 | 48.01 |
| 19 | 18.00 | 15 | 169.0 | 17 | 218.0 | 14 | 2,425.0 | 18 | 18.00 | 14 | 169.0 | 15 | 218.0 | 12 | 2,425.0 | 35 | 60.00 |
| 36 | 4.055 | 20 | 143.9 | 40 | 28.35 | 18 | 1,729.0 | 33 | 3.523 | 17 | 141.1 | 37 | 24.40 | 17 | 1,670.6 | 13 | 192.8 |
| 17 | 20.83 | 24 | 99.29 | 18 | 192.7 | 37 | 651.7 | 31 | 3.960 | 23 | 95.70 | 39 | 22.27 | 32 | 632.7 | 49 | 24.20 |
| 76 | 0.899 | 49 | 39.46 | 141 | 1.769 | 35 | 705.6 | 69 | 0.899 | 47 | 39.46 | 134 | 1.769 | 30 | 705.6 | 16 | 172.4 |
| 90 | 0.666 | 76 | 11.98 | 58 | 14.58 | 70 | 138.5 | 85 | [7]0.666 | 70 | [7]11.98 | 50 | [7]14.58 | 62 | [7]138.5 | 32 | 66.00 |
| 31 | 6.480 | 35 | 69.78 | 28 | 68.54 | 33 | 749.1 | 26 | 6.480 | 32 | 69.78 | 23 | 68.54 | 29 | 749.1 | 26 | 76.21 |
| 22 | 14.50 | 31 | 79.60 | 26 | 80.00 | 34 | 729.6 | 22 | 9.000 | 36 | 58.10 | 28 | 44.90 | 38 | 493.7 | 48 | 29.30 |
| 58 | 1.481 | 48 | 39.54 | 66 | 10.99 | 39 | 614.3 | 53 | 1.481 | 46 | 39.54 | 60 | 10.99 | 33 | 614.3 | 15 | 184.5 |
| 25 | 10.81 | 45 | 51.60 | 29 | 67.66 | 53 | 277.6 | 21 | 9.917 | 43 | 48.97 | 25 | 61.39 | 52 | 234.5 | 14 | 188.7 |
| 34 | 5.357 | 41 | 53.86 | 33 | 51.90 | 42 | 525.0 | 30 | 5.357 | 38 | 53.86 | 27 | 51.90 | 37 | 525.0 | 28 | 75.00 |
| 49 | [9]2.504 | 51 | [9]34.24 | 60 | [9]13.64 | 43 | [9]483.2 | 44 | [9]2.504 | 49 | [9]34.24 | 52 | [9]13.64 | 39 | [9]483.2 | 57 | 19.00 |
| 44 | 2.922 | 33 | 76.23 | 45 | 22.91 | 24 | 1,209.0 | 40 | 2.922 | 28 | 76.23 | 38 | 22.91 | 22 | 1,209.0 | 60 | 17.80 |
| 30 | 6.819 | 38 | 56.98 | 39 | 30.62 | 50 | 323.3 | 43 | 2.629 | 41 | 51.91 | 67 | 9.658 | 47 | 277.0 | 77 | 10.44 |
| 131 | 0.240 | 90 | 6.341 | 196 | 0.880 | 107 | 44.51 | 128 | 0.240 | 88 | 6.341 | 190 | 0.880 | 102 | 44.51 | 66 | 15.10 |
| 18 | 18.50 | 52 | 29.80 | 16 | 219.8 | 63 | 188.0 | 17 | 18.50 | 50 | 29.80 | 14 | 219.8 | 57 | 188.0 | 22 | 132.9 |
| 67 | 1.120 | 53 | 28.42 | 76 | 8.062 | 62 | 213.2 | 61 | 1.120 | 51 | 28.42 | 69 | 8.062 | 56 | 213.2 | 63 | 16.10 |
| 112 | 0.396 | 64 | 19.40 | 131 | 2.141 | 80 | 106.5 | 105 | 0.396 | 58 | 19.40 | 127 | 2.141 | 71 | 106.5 | 81 | 8.630 |

# OGJ400

| Rank by total — assets — 1989 | 1988 | Company | Total assets $000 | — Total revenue — Rank | $000 | — Net income — Rank | $000 | —— Stockholders' equity —— Rank | $000 | — Capital & Expl. spending — Rank | $000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | 59 | Apache Corp. | 764,368 | 58 | 246,850 | 55 | 22,122 | 47 | 350,263 | 46 | 113,451 |
| 53 | 55 | Hamilton Oil Corp. | 761,161 | 61 | 224,179 | 44 | 38,642 | 51 | 299,571 | 49 | 97,994 |
| 54 | 64 | Triton Energy Corp.[19] | 682,283 | 59 | 242,340 | 382 | (12,464) | 57 | 223,677 | 55 | 84,000 |
| 55 | 57 | Zapata Corp.[10] | 679,913 | 67 | 190,423 | 396 | (57,861) | 394 | (69,131 | 90 | 18,220 |
| 56 | 62 | Cenex, Farmer's Union Central Exchange, Inc[10] | 656,219 | 30 | 1,365,161 | 42 | 43,710 | 50 | 311,532 | 79 | 29,149 |
| 57 | 65 | Helmerich & Payne, Inc.[10] | 591,229 | 70 | 171,169 | 54 | 22,700 | 42 | 443,396 | 61 | 58,612 |
| 58 | 60 | Global Marine Inc.[26] | 572,800 | 66 | 197,000 | 397 | (61,500) | 167 | 12,900 | 115 | 9,900 |
| 59 | 67 | Hadson Corp. | 549,529 | 41 | 701,437 | 393 | (34,872) | 65 | 118,911 | 70 | 42,058 |
| 60 | 68 | Noble Affiliates, Inc. | 544,190 | 63 | 211,607 | 46 | 31,378 | 56 | 226,116 | 41 | 131,395 |
| 61 | 66 | Unimar Co. | 522,320 | 64 | 205,087 | 57 | 21,028 | 58 | [11]210,052 | 67 | 46,103 |
| 62 | 74 | NERCO Oil & Gas, Inc.[27] | 504,400 | 72 | 151,100 | 47 | [28]31,100 | 43 | 419,300 | 62 | 58,400 |
| 63 | 79 | Presidio Oil Co. | 497,774 | 84 | 72,265 | 388 | (17,465) | 101 | 44,378 | 82 | 27,994 |
| 64 | 71 | Adobe Resources Corp. | 480,854 | 71 | 158,490 | 384 | (13,105) | 49 | 341,910 | 57 | 73,459 |
| 65 | 81 | First Mississippi Corp.[29] | 477,389 | 48 | 439,128 | 60 | 16,511 | 61 | 192,140 | 48 | 107,011 |
| 66 | 69 | Forest Oil Corp. | 470,061 | 74 | 131,555 | 378 | (9,398) | 78 | 88,689 | 54 | 85,282 |
| 67 | 70 | Tesoro Petroleum Corp.[10] | 451,986 | 37 | 767,021 | 391 | (30,520) | 64 | 125,402 | 102 | 13,206 |
| 68 | 72 | Pogo Producing Co. | 420,896 | 76 | 122,735 | 375 | (5,587) | 161 | 13,996 | 78 | 30,396 |
| 69 | 61 | Sunshine Mining Co. | 418,775 | 80 | 98,930 | 394 | (38,345) | 75 | 92,537 | 91 | 17,308 |
| 70 | 73 | DEKALB Energy Co. | 416,263 | 82 | 81,020 | 50 | 25,928 | 54 | 242,321 | 63 | 53,542 |
| 71 | 84 | National Cooperative Refinery Association[29] | 351,359 | 43 | 664,124 | 30 | 78,073 | 60 | [30]201,859 | 96 | 15,895 |
| 72 | 82 | Southwestern Energy Co. | 347,212 | 75 | 125,694 | 62 | 13,979 | 69 | 103,455 | 71 | 38,982 |
| 73 | 78 | Southern Union Co. | 346,354 | 65 | 197,460 | 134 | 851 | 80 | 83,207 | 97 | 14,939 |
| 74 | 75 | Edisto Resources Corp.[31] | 338,590 | 85 | 66,001 | 395 | (57,326) | 67 | 116,177 | 65 | 49,884 |
| 75 | 83 | Seagull Energy Corp. | 330,787 | 68 | 182,455 | 64 | 11,674 | 70 | 101,941 | 74 | 35,405 |
| 76 | 87 | Pauley Petroleum, Inc.[10,32] | 283,337 | 53 | 341,716 | 152 | 509 | 94 | 57,026 | 69 | 43,198 |
| 77 | 85 | American Exploration Co. | 282,636 | 95 | 47,970 | 95 | 2,455 | 98 | 50,651 | 36 | 173,992 |
| 78 | 94 | Harken Energy Corp. | 279,128 | 33 | 1,117,131 | 369 | (3,330) | 105 | 40,678 | 59 | 63,312 |
| 79 | 89 | Norcen Energy Resources Ltd. (US Operations) | 263,921 | 87 | 64,628 | 49 | 26,180 | — | NA | 66 | 48,210 |
| 80 | 92 | NOMECO Oil & Gas Co.[33] | 247,978 | 86 | 65,063 | 78 | 4,335 | 63 | 129,424 | 58 | 63,631 |
| 81 | 91 | AMAX Oil & Gas Inc.[34] | 230,284 | 88 | 61,954 | 67 | 11,480 | 59 | 209,585 | 73 | 35,520 |
| 82 | 86 | Diamond Shamrock Offshore Partners L.P.[35] | 217,149 | 77 | 115,752 | 88 | 2,931 | 62 | [11]183,979 | 76 | 31,672 |
| 83 | 90 | TGX Corp.[36] | 215,468 | 73 | 140,258 | 383 | (13,067) | 79 | 84,787 | 203 | 966 |
| 84 | 98 | Noble Drilling Corp. | 176,554 | 79 | 107,104 | 377 | (6,883) | 66 | 118,656 | 107 | 11,952 |
| 85 | 100 | Parker & Parsley Development Partners L.P. | 172,385 | 91 | 56,486 | 65 | 11,653 | 68 | [11]110,540 | 88 | 19,048 |
| 86 | 102 | Wainoco Oil Corp. | 169,796 | 103 | 39,926 | 103 | 1,800 | 82 | 80,136 | 77 | 31,147 |
| 87 | 95 | Allegheny & Western Energy Corp.[29] | 167,837 | 69 | 180,646 | 83 | 3,324 | 77 | 89,881 | 109 | 11,085 |
| 88 | 103 | Conquest Exploration Co. | 165,594 | 93 | 51,185 | 321 | (577) | 84 | 72,513 | 101 | 13,222 |
| 89 | 96 | Snyder Oil Partners L.P.[37] | 156,766 | 90 | 58,718 | 89 | 2,919 | 73 | [11]95,533 | 130 | 5,374 |
| 90 | 101 | Bridge Oil (U.S.A.) Inc.[38] | 151,691 | 94 | 50,608 | 320 | (572) | 85 | 72,036 | 81 | 28,920 |
| 91 | 99 | Global Natural Resources Inc. | 151,219 | 98 | 45,923 | 96 | 2,440 | 81 | 80,380 | 92 | 17,109 |
| 92 | 104 | Howell Corp. | 124,109 | 56 | 284,138 | 70 | 8,243 | 114 | 32,208 | 112 | 10,597 |
| 93 | 124 | Berry Petroleum Co. | 115,597 | 96 | 46,430 | 63 | 13,123 | 71 | 98,226 | 129 | 5,854 |
| 94 | 105 | Avalon Corp.[39] | 108,780 | 129 | 19,232 | 379 | (9,898) | 74 | 94,615 | 116 | 9,557 |
| 95 | 107 | The Wiser Oil Co. | 105,632 | 101 | 40,514 | 73 | 6,793 | 76 | 91,622 | 89 | 18,892 |
| 96 | 146 | Beard Oil Co. | 103,348 | 112 | 26,511 | 197 | 74 | 111 | 35,744 | 85 | 20,605 |
| 97 | 114 | Crystal Oil Co. | 99,240 | 109 | 29,262 | 80 | 3,723 | 86 | 71,141 | 163 | 2,333 |
| 98 | 112 | Devon Energy Corp. | 97,916 | 110 | 28,819 | 132 | 876 | 87 | 70,156 | 95 | 16,135 |
| 99 | 109 | San Juan Basin Royalty Trust | 97,051 | 178 | 8,422 | 71 | 8,008 | 72 | [40]96,763 | — | 0 |
| 100 | — | Energy Ventures Inc. | 94,718 | 78 | 108,791 | 91 | 2,851 | 124 | 26,455 | 118 | 8,763 |
| 101 | 118 | Exploration Co. of Louisiana, Inc. | 90,711 | 171 | 9,320 | 119 | 1,122 | 91 | 64,486 | 72 | 35,693 |
| 102 | 116 | Patrick Petroleum Co. | 87,851 | 151 | 13,284 | 133 | 862 | 96 | 54,151 | 87 | 19,617 |

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 42 | 3.074 | 30 | 84.95 | 53 | 16.77 | 44 | 472.1 | 37 | 3.074 | 25 | 84.95 | 47 | 16.77 | 40 | 472.1 | 34 | 60.84 |
| 50 | 2.142 | 43 | 52.75 | 31 | 59.27 | 26 | 922.1 | 118 | 0.289 | 92 | 6.103 | 117 | 2.615 | 135 | 25.39 | 96 | 5.480 |
| 35 | 4.186 | 55 | 23.64 | 36 | 41.73 | 65 | 156.8 | 76 | 0.838 | 80 | 8.039 | 105 | 3.508 | 114 | 36.17 | 92 | 6.670 |
| 153 | 0.165 | 65 | 17.98 | 150 | 1.522 | 79 | 108.6 | 166 | 0.123 | 60 | 16.67 | 204 | 0.681 | 78 | 79.67 | 224 | 0.080 |
| 54 | 1.663 | 198 | 0.822 | 68 | 9.848 | 224 | 6.395 | 49 | 1.663 | 193 | 0.822 | 63 | 9.848 | 218 | 6.395 | 71 | 13.00 |
| 75 | 0.907 | 61 | 20.98 | 75 | 8.619 | 52 | 291.6 | 68 | 0.907 | 56 | 20.98 | 68 | 8.619 | 46 | 291.6 | 64 | 15.21 |
| 127 | 0.254 | 98 | 5.232 | 162 | 1.309 | 101 | 52.31 | 124 | 0.254 | 97 | 5.232 | 155 | 1.309 | 96 | 52.31 | 202 | 0.360 |
| 81 | 0.802 | 104 | 4.789 | 74 | 9.066 | 112 | 41.21 | 129 | 0.240 | 102 | 4.789 | 150 | 1.475 | 108 | 41.21 | 174 | 0.840 |
| 37 | 3.721 | 40 | 54.31 | 37 | 36.82 | 47 | 352.6 | 34 | 3.488 | 40 | 52.87 | 31 | 33.53 | 43 | 331.1 | 44 | 39.44 |
| 51 | 2.093 | 29 | 85.59 | 55 | 15.93 | 29 | 873.5 | 81 | 0.727 | 76 | 9.828 | 83 | 5.275 | 91 | 56.31 | 143 | 1.900 |
| 57 | 1.545 | 44 | 51.73 | 70 | 9.750 | 51 | 321.3 | 52 | 1.545 | 42 | 51.73 | 65 | 9.750 | 45 | 321.3 | 159 | 1.360 |
| 56 | 1.599 | 66 | 17.50 | 49 | 20.73 | 57 | 241.2 | 51 | 1.599 | 59 | 17.50 | 43 | 20.73 | 50 | 241.2 | 50 | 24.00 |
| 46 | 2.787 | 57 | 22.15 | 38 | 34.48 | 59 | 233.7 | 48 | 1.688 | 53 | 22.15 | 32 | 28.64 | 54 | 233.7 | 83 | 8.410 |
| 111 | 0.418 | 88 | 6.701 | 101 | 4.590 | 110 | 41.56 | 104 | 0.418 | 86 | 6.701 | 93 | 4.590 | 105 | 41.56 | 105 | 4.200 |
| 98 | 0.552 | 50 | 36.53 | 72 | 9.262 | 54 | 272.9 | 106 | 0.382 | 48 | 34.61 | 75 | 6.980 | 51 | 235.9 | 85 | 8.000 |
| 86 | 0.730 | 308 | 0.107 | 108 | 3.815 | 330 | 0.568 | 374 | 0.002 | 308 | 0.107 | — | 0 | 330 | 0.568 | — | 0 |
| 47 | 2.706 | 47 | 39.68 | 51 | 17.66 | 58 | 234.1 | 41 | 2.706 | 45 | 39.68 | 45 | 17.66 | 53 | 234.1 | 82 | 8.600 |
| 74 | 0.913 | 67 | 16.35 | 78 | 7.483 | 66 | 154.7 | 72 | 0.851 | 66 | 12.95 | 77 | 5.951 | 70 | 108.0 | 91 | 6.790 |
| 45 | 2.814 | 56 | 22.21 | 42 | 26.97 | 48 | 351.7 | 47 | 1.870 | 77 | 8.825 | 61 | 10.02 | 93 | 55.17 | 51 | 21.00 |
| 68 | 1.232 | 115 | 4.172 | 89 | 5.709 | 89 | 70.10 | 60 | 1.232 | 113 | 4.172 | 81 | 5.709 | 82 | 70.10 | 74 | 11.90 |
| 160 | 0.148 | 71 | 15.28 | 204 | 0.745 | 55 | 252.9 | 155 | 0.148 | 63 | 15.28 | 198 | 0.745 | 48 | 252.9 | 52 | 23.70 |
| 142 | 0.198 | 107 | 4.558 | 145 | 1.692 | 88 | 73.35 | 140 | 0.198 | 105 | 4.558 | 138 | 1.692 | 81 | 73.35 | 100 | 5.100 |
| 94 | 0.637 | 54 | 25.59 | 71 | 9.726 | 72 | 136.7 | 87 | 0.637 | 52 | 25.59 | 66 | 9.726 | 64 | 136.7 | 58 | 18.30 |
| 110 | 0.437 | 84 | 7.840 | 110 | 3.669 | 86 | 74.72 | 103 | 0.437 | 82 | 7.840 | 103 | 3.669 | 79 | 74.72 | 88 | 7.580 |
| 39 | 3.327 | 70 | 15.59 | 63 | 12.48 | 82 | 95.37 | 36 | 3.327 | 62 | 15.59 | 56 | 12.48 | 73 | 95.37 | 45 | 35.20 |
| 70 | 1.040 | 79 | 10.96 | 77 | 7.678 | 78 | 110.3 | 65 | 1.040 | 73 | 10.96 | 70 | 7.678 | 69 | 110.3 | 76 | 10.88 |
| 129 | 0.250 | 149 | 2.092 | 137 | 1.880 | 124 | 29.30 | 126 | 0.250 | 148 | 2.092 | 132 | 1.880 | 120 | 29.30 | — | NA |
| 87 | 0.727 | 78 | 11.34 | 92 | 5.239 | 73 | 125.3 | 82 | 0.727 | 72 | 11.34 | 84 | 5.239 | 65 | 125.3 | 61 | 17.70 |
| 64 | 1.345 | 77 | 11.73 | 52 | 17.07 | 76 | 119.2 | 62 | 1.113 | 71 | 11.73 | 55 | 12.90 | 68 | 114.8 | — | NA |
| 63 | 1.345 | 62 | 20.79 | 59 | 14.56 | 56 | 248.8 | 56 | 1.345 | 57 | 20.79 | 51 | 14.56 | 49 | 248.8 | 42 | 45.10 |
| 52 | 1.977 | 46 | 41.73 | 69 | 9.830 | 64 | 163.6 | 46 | 1.977 | 44 | 41.73 | 64 | 9.830 | 58 | 163.6 | 122 | 2.900 |
| 151 | 0.170 | 108 | 4.500 | 142 | 1.746 | 69 | 146.8 | 147 | 0.170 | 106 | 4.500 | 135 | 1.746 | 60 | 146.8 | — | 0 |
| 161 | 0.144 | 205 | 0.710 | 179 | 1.062 | 198 | 10.80 | 257 | 0.036 | 206 | 0.612 | 265 | 0.252 | 252 | 3.600 | 153 | 1.500 |
| 60 | 1.407 | 75 | 12.53 | 48 | 21.17 | 81 | 102.7 | 55 | 1.407 | 69 | 12.53 | 42 | 21.17 | 72 | 102.7 | 53 | 23.20 |
| 93 | 0.637 | 63 | 20.23 | 84 | 6.225 | 61 | 230.7 | 113 | 0.324 | 125 | 2.977 | 101 | 3.785 | 106 | 41.49 | 68 | 13.92 |
| 330 | 0.011 | 146 | 2.173 | 333 | 0.073 | 145 | 24.06 | 327 | 0.011 | 145 | 2.173 | 330 | 0.073 | 142 | 24.06 | 99 | 5.300 |
| 72 | 0.974 | 68 | 16.12 | 83 | 6.410 | 77 | 112.2 | 74 | 0.844 | 68 | 12.87 | 87 | 4.939 | 84 | 67.34 | 97 | 5.450 |
| 69 | 1.048 | 73 | 13.44 | 67 | 9.881 | 75 | 120.7 | 64 | 1.048 | 65 | 13.44 | 62 | 9.881 | 67 | 120.7 | 193 | 0.500 |
| 65 | 1.335 | 72 | 14.01 | 65 | 11.39 | 90 | 68.22 | 57 | 1.335 | 64 | 14.01 | 59 | 11.39 | 83 | 68.22 | — | NA |
| 97 | 0.598 | 80 | 10.59 | 95 | 4.902 | 67 | 154.6 | 89 | [7]0.557 | 79 | [7]8.336 | 95 | [7]4.112 | 74 | [7]94.07 | 93 | 6.500 |
| 77 | 0.866 | 96 | 5.470 | 81 | 7.038 | 87 | 74.32 | 70 | 0.866 | 95 | 5.470 | 74 | 7.038 | 80 | 74.32 | 196 | 0.480 |
| 43 | 3.024 | 237 | 0.407 | 30 | 65.57 | 155 | 19.66 | 38 | 3.024 | 234 | 0.407 | 24 | 65.57 | 152 | 19.66 | 107 | 4.000 |
| 96 | 0.603 | 101 | 4.947 | 117 | 3.027 | 252 | 3.694 | 108 | 0.355 | 222 | 0.491 | 111 | 3.027 | 249 | 3.694 | 67 | 14.50 |
| 59 | 1.447 | 99 | 5.158 | 62 | 13.49 | 85 | 80.80 | 54 | 1.447 | 98 | 5.158 | 54 | 13.49 | 77 | 80.80 | 46 | 34.16 |
| 78 | 0.856 | 138 | 2.481 | 105 | 4.039 | 183 | 13.00 | 71 | 0.856 | 136 | 2.481 | 98 | 4.039 | 180 | 13.00 | 38 | 57.22 |
| 79 | 0.847 | 86 | 7.159 | 93 | 5.026 | 105 | 45.93 | 73 | 0.847 | 84 | 7.159 | 85 | 5.026 | 100 | 45.93 | 104 | 4.200 |
| 89 | 0.681 | 85 | 7.776 | 98 | 4.800 | 68 | 149.8 | 84 | 0.681 | 83 | 7.776 | 90 | 4.800 | 59 | 149.8 | 86 | 7.710 |
| 306 | 0.018 | 105 | 4.720 | 168 | 1.198 | 49 | 328.9 | 303 | 0.018 | 103 | 4.720 | 160 | 1.198 | 44 | 328.9 | 165 | 1.100 |
| 288 | 0.024 | 140 | 2.363 | 328 | 0.089 | 193 | 10.97 | 285 | 0.024 | 139 | 2.363 | 324 | 0.089 | 189 | 10.97 | — | 0 |
| 210 | 0.079 | 134 | 2.606 | 178 | 1.066 | 106 | 44.99 | 205 | 0.079 | 132 | 2.606 | 172 | 1.066 | 101 | 44.99 | 116 | 3.337 |
| 135 | 0.226 | 122 | 3.293 | 167 | 1.201 | 132 | 28.29 | 133 | 0.226 | 119 | 3.293 | 159 | 1.201 | 127 | 28.29 | — | NA |

| Rank by total — assets — | | | Total assets | — Total revenue — | | — Net income — | | — Stockholders' equity — | | — Capital & Expl. spending — | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1989 | 1988 | Company | $000 | Rank | $000 | Rank | $000 | Rank | $000 | Rank | $000 |
| 103 | 139 | Wolverine Exploration Co. | 86,352 | 168 | 9,827 | 386 | (15,482) | 381 | (1,778 | 64 | 50,295 |
| 104 | 171 | Swift Energy Co. | 85,007 | 145 | 14,932 | 75 | 5,709 | 120 | 27,809 | 147 | 3,375 |
| 105 | 108 | Sage Energy Co.[29] | 84,296 | 107 | 33,192 | 376 | (5,941) | 122 | 26,862 | 125 | 6,641 |
| 106 | 129 | Fuel Resources Inc.[10,41] | 84,133 | 102 | 40,503 | — | NA | — | NA | 84 | 25,901 |
| 107 | 113 | Integrated Drilling and Exploration Inc.[42] | 82,956 | 134 | 17,472 | 368 | (3,308) | 88 | 67,453 | 121 | 7,265 |
| 108 | 110 | Damson Oil Corp.[10] | 81,691 | 123 | 20,722 | 385 | (13,170) | 391 | (19,890 | 157 | 2,633 |
| 109 | 142 | Kelley Oil & Gas Partners, Ltd. | 81,324 | 122 | 21,082 | 79 | 4,254 | 83 | [11]75,688 | 75 | 35,188 |
| 110 | 128 | Unit Corp. | 76,422 | 104 | 39,541 | 354 | (1,598) | 109 | 37,150 | 93 | 17,014 |
| 111 | 111 | Key Production Co. Inc. | 75,340 | 108 | 32,654 | 86 | 3,063 | 107 | 40,193 | 168 | 2,095 |
| 112 | 166 | Hallwood Energy Corp.[43] | 74,779 | 146 | 14,464 | 297 | (279) | 149 | 17,415 | 197 | 1,060 |
| 113 | 123 | Tom Brown Inc.[44] | 73,878 | 133 | 17,926 | 365 | (3,075) | 125 | 25,996 | 117 | 8,893 |
| 114 | 119 | Prudential-Bache Energy Income L.P. V P-21 | 73,483 | 131 | 18,654 | 82 | 3,341 | 90 | [11]66,242 | 123 | 6,791 |
| 115 | 127 | Production Operators Corp.[10] | 73,298 | 92 | 54,597 | 77 | 4,522 | 119 | 29,086 | 94 | 16,485 |
| 116 | 115 | Prudential-Bache Energy Income L.P. V P-19 | 73,083 | 124 | 20,529 | 345 | (1,208) | 89 | [11]66,346 | 174 | 1,804 |
| 117 | 185 | Hallwood Energy Partners, L.P.[45] | 70,852 | 149 | 13,613 | 190 | 101 | 148 | [11]17,416 | 211 | 806 |
| 118 | 117 | Prudential-Bache Energy Income L.P. IV P-17 | 69,830 | 116 | 23,517 | 81 | 3,404 | 92 | [11]63,092 | 198 | 1,058 |
| 119 | 122 | Plains Resources Inc. | 69,274 | 127 | 19,902 | 157 | 456 | 131 | 24,059 | 83 | 27,434 |
| 120 | 134 | Thermal Exploration[10,46] | 69,063 | 137 | 16,013 | 109 | 1,557 | — | NA | 86 | 20,597 |
| 121 | 121 | Prudential-Bache Energy Income L.P. IV P-16 | 65,359 | 117 | 22,235 | 98 | 2,162 | 93 | [11]58,715 | 199 | 1,049 |
| 122 | 120 | Buttes Gas & Oil Co. | 65,054 | 132 | 18,467 | 351 | (1,481) | 126 | 25,514 | 140 | 4,229 |
| 123 | 125 | Prudential-Bache Energy Income L.P. VP-22 | 61,364 | 153 | 12,942 | 127 | 1,009 | 95 | [11]54,794 | 100 | 13,544 |
| 124 | 135 | Plains Petroleum Co. | 60,914 | 99 | 42,242 | 61 | [47]16,087 | 99 | 50,389 | 106 | 12,109 |
| 125 | 133 | Samson Energy Co. L.P. | 59,863 | 142 | 15,501 | 106 | 1,603 | 106 | [11]40,327 | 104 | 12,679 |
| 126 | 132 | Equity Oil Co. | 56,826 | 143 | 15,350 | 108 | 1,587 | 104 | 41,915 | 131 | 5,257 |
| 127 | 126 | Prudential-Bache Energy Income L.P. V P-18 | 56,526 | 139 | 15,975 | 224 | 1 | 97 | [11]51,334 | 182 | 1,323 |
| 128 | 130 | Prudential-Bache Energy Income L.P. V P-20 | 52,161 | 154 | 12,937 | 99 | 2,149 | 100 | [11]47,225 | 145 | 3,540 |
| 129 | 180 | Taurus Exploration, Inc.[10,48] | 48,596 | 150 | 13,469 | 87 | 2,937 | 151 | 17,336 | 98 | 14,805 |
| 130 | 145 | Apache Offshore Investment Partnership[50] | 48,185 | 158 | 12,238 | 387 | (17,296) | 380 | [11](726) | 127 | 6,128 |
| 131 | 157 | Coho Resources Inc.[51] | 48,133 | 136 | 16,458 | 69 | 9,240 | 385 | (4,738) | 80 | 29,024 |
| 132 | 136 | Prudential-Bache Energy Income L.P. III P-14 | 46,770 | 162 | 11,062 | 115 | 1,225 | 102 | [11]43,020 | 249 | 401 |
| 133 | 131 | Calumet Industries Inc.[10] | 46,678 | 100 | 41,425 | 380 | (10,217) | 186 | 8,839 | 219 | 701 |
| 134 | 153 | Alamco, Inc. | 46,264 | 155 | 12,712 | 76 | 4,729 | 156 | 14,914 | 229 | 565 |
| 135 | 141 | Fuel Resources Development Co. (FUELCO)[52] | 45,743 | 89 | 60,533 | 312 | (458) | 135 | 21,943 | 149 | 3,309 |
| 136 | 140 | Prudential-Bache Energy Growth Fund, L.P. G-1 | 45,453 | 172 | 9,308 | 364 | (2,997) | 103 | [11]42,988 | 360 | 25 |
| 137 | 150 | Penn Virginia Resources Corp. (Oil and gas)[53] | 45,449 | 186 | 6,914 | 356 | [3](1,689) | — | NA | 124 | 6,758 |
| 138 | 173 | Texas Meridian Resources Ltd. | 45,387 | 156 | 12,712 | 347 | (1,300) | 174 | [11]10,776 | 105 | 12,310 |
| 139 | 144 | Wilshire Oil Co. of Texas | 45,238 | 165 | 10,463 | 171 | 230 | 163 | 13,929 | 152 | 3,013 |
| 140 | 143 | American National Petroleum Co. | 44,512 | 126 | 20,266 | 143 | 697 | 159 | 14,356 | 161 | 2,411 |
| 141 | 157 | Bogert Oil Co.[10] | 43,499 | 135 | 16,811 | 328 | (657) | 139 | 20,381 | 120 | 7,990 |
| 142 | 148 | Prudential-Bache Energy Income L.P. III P-12 | 42,200 | 167 | 10,031 | 93 | 2,668 | 108 | [11]38,484 | 310 | 98 |
| 143 | 181 | KCS Group Inc.[10] | 42,166 | 83 | 73,655 | 68 | 9,686 | 138 | 20,751 | 141 | 3,795 |
| 144 | 151 | Clinton Gas Systems, Inc. | 41,360 | 97 | 46,276 | 196 | 76 | 140 | 19,620 | 138 | 4,452 |
| 145 | 161 | McFarland Energy Inc. | 41,042 | 144 | 15,281 | 110 | 1,520 | 118 | 29,201 | 128 | 5,871 |
| 146 | 149 | Prudential-Bache Energy Income L.P. III P-15 | 40,307 | 170 | 9,507 | 124 | 1,019 | 110 | [11]37,093 | 259 | 337 |
| 147 | 167 | Fidelity Oil Group[54] | 40,034 | 140 | 15,928 | 72 | 6,830 | 115 | 31,396 | 103 | 13,111 |
| 148 | 158 | Phoenix Resource Companies, Inc.[55] | 39,460 | 106 | 35,701 | 158 | 430 | 390 | (14,914) | 114 | 10,261 |
| 149 | 172 | Mission Resource Partners, L.P. | 39,408 | 130 | 19,207 | 100 | 2,069 | 153 | [11]16,572 | 99 | 14,367 |
| 150 | 162 | Maynard Oil Co. | 38,918 | 128 | 19,436 | 97 | 2,337 | 116 | 30,822 | 119 | 8,091 |
| 151 | 192 | Geodyne Resources, Inc.[56] | 37,446 | 114 | 25,756 | 74 | 5,886 | 143 | 18,655 | 200 | 1,026 |
| 152 | 218 | Nucorp, Inc. | 36,730 | 181 | 7,750 | 139 | 725 | 112 | 34,971 | 213 | 771 |
| 153 | 154 | OKC Limited Partnership | 35,386 | 111 | 27,556 | 362 | (2,477) | 164 | [11]13,625 | 113 | 10,563 |

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 134 | 0.232 | 147 | 2.111 | 161 | 1.379 | 130 | 28.81 | 132 | [7]0.232 | 146 | [7]2.111 | 154 | [7]1.379 | 125 | [7]28.81 | 43 | 39.70 |
| 193 | 0.093 | 177 | 1.341 | 159 | 1.423 | 174 | 14.95 | 189 | 0.093 | 174 | 1.341 | 153 | 1.423 | 171 | 14.95 | — | 0 |
| 55 | 1.602 | 103 | 4.816 | 57 | 14.63 | 127 | 29.08 | 50 | 1.602 | 101 | 4.816 | 49 | 14.63 | 123 | 29.08 | 69 | 13.66 |
| 201 | 0.089 | 97 | 5.281 | 245 | 0.365 | 93 | 63.22 | 195 | 0.089 | 96 | 5.281 | 238 | 0.365 | 86 | 63.22 | — | NA |
| 183 | 0.103 | 132 | 2.763 | 175 | 1.107 | 102 | 50.78 | 180 | 0.103 | 130 | 2.763 | 169 | 1.107 | 97 | 50.78 | 108 | 4.000 |
| 115 | 0.341 | 136 | 2.558 | 158 | 1.426 | 156 | 19.42 | 110 | 0.341 | 134 | 2.558 | 152 | 1.426 | 153 | 19.42 | — | 0 |
| 162 | 0.139 | 83 | 7.890 | 202 | 0.769 | 84 | 88.19 | 157 | 0.139 | 81 | 7.890 | 196 | 0.769 | 76 | 88.19 | 73 | 12.49 |
| 119 | 0.311 | 106 | 4.593 | 134 | 2.028 | 126 | 29.15 | 115 | 0.311 | 104 | 4.593 | 130 | 2.028 | 122 | 29.15 | 55 | 20.74 |
| 106 | 0.522 | 74 | 12.89 | 122 | 2.628 | 98 | 56.16 | 96 | 0.522 | 67 | 12.89 | 116 | 2.628 | 92 | 56.16 | 211 | 0.210 |
| 103 | 0.537 | 144 | 2.245 | 97 | 4.808 | 142 | 24.63 | 94 | 0.537 | 143 | 2.245 | 89 | 4.808 | 138 | 24.63 | 147 | 1.670 |
| 92 | 0.655 | 121 | 3.318 | 94 | 5.018 | 95 | 61.35 | 86 | 0.655 | 118 | 3.318 | 86 | 5.018 | 88 | 61.35 | 109 | 3.800 |
| 109 | 0.455 | 102 | 4.917 | 79 | 7.267 | 97 | 56.94 | 101 | 0.455 | 100 | 4.917 | 72 | 7.267 | 90 | 56.94 | — | 0 |
| 107 | 0.512 | 154 | 1.806 | 157 | 1.440 | 231 | 5.401 | 99 | 0.512 | 151 | 1.806 | 151 | 1.440 | 225 | 5.401 | — | 0 |
| 88 | 0.717 | 112 | 4.254 | 91 | 5.381 | 158 | 19.22 | 83 | 0.717 | 110 | 4.254 | 82 | 5.381 | 155 | 19.22 | — | 0 |
| 105 | 0.522 | 145 | 2.229 | 99 | 4.697 | 144 | 24.48 | 97 | 0.522 | 144 | 2.229 | 91 | 4.697 | 141 | 24.48 | 149 | 1.520 |
| 104 | 0.530 | 89 | 6.503 | 107 | 3.888 | 121 | 30.05 | 95 | 0.530 | 87 | 6.503 | 100 | 3.888 | 118 | 30.05 | — | 0 |
| 146 | 0.178 | 111 | 4.388 | 118 | 2.900 | 108 | 43.36 | 143 | 0.178 | 109 | 4.388 | 112 | 2.900 | 103 | 43.36 | 84 | 8.400 |
| 116 | 0.326 | 114 | 4.184 | 140 | 1.770 | 114 | 39.69 | 111 | 0.326 | 112 | 4.184 | 141 | 1.631 | 115 | 34.40 | 62 | 16.90 |
| 102 | 0.537 | 95 | 6.017 | 103 | 4.080 | 133 | 28.07 | 93 | 0.537 | 94 | 6.017 | 96 | 4.080 | 128 | 28.07 | — | 0 |
| 156 | 0.161 | 159 | 1.756 | 180 | 1.051 | 96 | 60.18 | 151 | 0.161 | 156 | 1.756 | 173 | 1.051 | 89 | 60.18 | 94 | 6.500 |
| 138 | 0.215 | 109 | 4.480 | 129 | 2.176 | 99 | 53.28 | 136 | 0.215 | 107 | 4.480 | 125 | 2.176 | 94 | 53.28 | — | 0 |
| 122 | 0.281 | 59 | 21.56 | 113 | 3.231 | 46 | 356.7 | 119 | 0.281 | 55 | 21.56 | 107 | 3.231 | 42 | 356.7 | 31 | 66.00 |
| 140 | 0.206 | 94 | 6.061 | 177 | 1.084 | 103 | 50.75 | 138 | 0.206 | 93 | 6.061 | 171 | 1.084 | 98 | 50.75 | — | NA |
| 91 | 0.665 | 186 | 1.083 | 73 | 9.251 | 123 | 29.84 | 98 | 0.522 | 199 | 0.716 | 71 | 7.584 | 139 | 24.60 | 115 | 3.390 |
| 108 | 0.490 | 113 | 4.245 | 104 | 4.062 | 171 | 15.56 | 100 | 0.490 | 111 | 4.245 | 97 | 4.062 | 168 | 15.56 | — | 0 |
| 114 | 0.354 | 126 | 3.025 | 88 | 5.768 | 116 | 37.61 | 109 | 0.354 | 123 | 3.025 | 80 | 5.768 | 110 | 37.61 | — | 0 |
| 190 | 0.095 | 100 | 4.964 | 265 | 0.264 | 122 | [40]29.86 | 186 | 0.095 | 99 | 4.964 | 258 | 0.264 | 119 | [40]29.86 | 78 | 9.500 |
| 202 | 0.088 | 91 | 6.317 | 220 | 0.589 | 143 | 24.59 | 197 | 0.088 | 89 | 6.317 | 214 | 0.589 | 140 | 24.59 | 133 | 2.000 |
| 73 | 0.947 | 361 | 0.034 | 50 | 18.50 | 175 | 14.44 | 67 | 0.947 | 360 | 0.034 | 44 | 18.50 | 172 | 14.44 | 56 | 19.70 |
| 124 | 0.276 | 127 | 2.986 | 133 | 2.045 | 120 | 31.23 | 121 | 0.276 | 124 | 2.986 | 129 | 2.045 | 117 | 31.23 | — | 0 |
| 239 | 0.049 | — | 0 | 249 | 0.331 | — | 0 | 233 | 0.049 | — | 0 | 242 | 0.331 | — | 0 | — | 0 |
| 272 | 0.031 | 143 | 2.277 | 226 | 0.507 | 136 | 26.86 | 270 | 0.031 | 142 | 2.277 | 219 | 0.507 | 131 | 26.86 | 125 | 2.600 |
| 126 | 0.272 | 125 | 3.073 | 195 | 0.888 | 94 | 62.02 | 123 | 0.272 | 122 | 3.073 | 189 | 0.888 | 87 | 62.02 | 113 | 3.430 |
| 301 | 0.021 | 202 | 0.766 | 302 | 0.138 | 196 | 10.89 | 295 | 0.021 | 196 | 0.766 | 299 | 0.138 | 192 | 10.89 | — | 0 |
| 304 | 0.020 | 148 | 2.100 | 279 | 0.209 | 111 | 41.30 | 298 | 0.020 | 147 | 2.100 | 276 | 0.209 | 107 | 41.30 | — | NA |
| 128 | 0.252 | 117 | 3.768 | 124 | 2.391 | 100 | 52.53 | 125 | 0.252 | 115 | 3.768 | 120 | 2.391 | 95 | 52.53 | 95 | 6.300 |
| 144 | 0.182 | 120 | 3.396 | 136 | 1.968 | 115 | 37.90 | 161 | 0.130 | 138 | 2.414 | 179 | 0.983 | 184 | 12.31 | 124 | 2.700 |
| 136 | 0.223 | 119 | 3.443 | 151 | 1.520 | 118 | 36.66 | 134 | 0.223 | 117 | 3.443 | 144 | 1.520 | 113 | 36.66 | 175 | 0.820 |
| 123 | 0.280 | 93 | 6.137 | 126 | 2.257 | 104 | 49.08 | 120 | 0.280 | 91 | 6.137 | 122 | 2.257 | 99 | 49.08 | 79 | 9.400 |
| 166 | 0.132 | 133 | 2.757 | 171 | 1.137 | 91 | 66.94 | 160 | 0.132 | 131 | 2.757 | 165 | 1.137 | 85 | 66.94 | — | 0 |
| 209 | 0.079 | 169 | 1.513 | 229 | 0.479 | 169 | 16.40 | 204 | 0.079 | 166 | 1.513 | 222 | 0.479 | 166 | 16.40 | 131 | 2.125 |
| 211 | 0.078 | 150 | 2.071 | 237 | 0.424 | 167 | 16.54 | 206 | 0.078 | 149 | 2.071 | 230 | 0.424 | 164 | 16.54 | 72 | 12.69 |
| 83 | 0.777 | 162 | 1.720 | 80 | 7.103 | 201 | 10.20 | 78 | 0.777 | 159 | 1.720 | 73 | 7.103 | 194 | 10.20 | 111 | 3.700 |
| 132 | 0.233 | 135 | 2.578 | 144 | 1.734 | 137 | 26.79 | 130 | 0.233 | 133 | 2.578 | 137 | 1.734 | 132 | 26.79 | — | 0 |
| 62 | 1.348 | 166 | 1.605 | 64 | 12.00 | 197 | 10.80 | 58 | 1.328 | 165 | 1.516 | 58 | 11.90 | 196 | 9.600 | 70 | 13.00 |
| 61 | 1.400 | 292 | 0.140 | 90 | 5.613 | 211 | 8.275 | 266 | 0.033 | 291 | 0.140 | 275 | 0.212 | 313 | 0.925 | 204 | 0.340 |
| 80 | 0.839 | 139 | 2.427 | 46 | 21.94 | 176 | 14.34 | 75 | 0.839 | 137 | 2.427 | 40 | 21.94 | 173 | 14.34 | 36 | 60.00 |
| 121 | 0.290 | 123 | 3.135 | 143 | 1.738 | 146 | 23.27 | 117 | 0.290 | 120 | 3.135 | 136 | 1.738 | 143 | 23.27 | 89 | 7.384 |
| 174 | 0.119 | 160 | 1.748 | 187 | 0.960 | 154 | 20.07 | 170 | 0.119 | 157 | 1.748 | 181 | 0.960 | 151 | 20.07 | 200 | 0.400 |
| 137 | 0.219 | 197 | 0.885 | 153 | 1.500 | 244 | 3.954 | 135 | 0.219 | 192 | 0.885 | 146 | 1.500 | 240 | 3.954 | — | 0 |
| 85 | 0.732 | 87 | 6.808 | 112 | 3.263 | 117 | 37.50 | 80 | 0.732 | 85 | 6.808 | 106 | 3.263 | 111 | 37.50 | 192 | 0.500 |

| Rank by total assets | | | Total assets | Total revenue | | Net income | | Stockholders' equity | | Capital & Expl. spending | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1989 | 1988 | Company | $000 | Rank | $000 | Rank | $000 | Rank | $000 | Rank | $000 |
| 154 | 193 | New London Inc.[44,57] | 35,226 | 119 | 21,716 | 151 | 513 | 150 | 17,347 | 151 | 3,016 |
| 155 | 206 | Garnet Resources Corp. | 35,079 | 278 | 1,386 | 340 | (986) | 113 | 32,593 | 142 | 3,782 |
| 156 | 232 | Castle Energy Corp.[10] | 34,752 | 184 | 7,292 | 114 | 1,245 | 154 | 16,137 | 193 | 1,111 |
| 157 | 170 | Comstock Resources, Inc. | 32,772 | 179 | 8,045 | 122 | 1,085 | 146 | 17,668 | 185 | 1,284 |
| 158 | — | Enex Program I Partners, L.P. | 31,858 | 190 | 6,257 | 168 | 294 | 128 | [11]25,100 | 286 | 201 |
| 159 | 213 | Kelley Oil Corp. | 31,039 | 105 | 35,815 | 147 | 592 | 185 | 9,064 | 122 | 6,979 |
| 160 | 159 | Paine Webber/Geodyne Energy Income L.P. II-A | 30,955 | 159 | 12,067 | 137 | 737 | 117 | [11]30,585 | 241 | 466 |
| 161 | 178 | Alexander Energy Corp. | 30,867 | 209 | 4,206 | 317 | (519) | 179 | 9,926 | 164 | 2,330 |
| 162 | 164 | Prudential-Bache Energy Income L.P. III P-13 | 29,939 | 185 | 7,051 | 142 | 697 | 121 | [11]27,514 | 273 | 257 |
| 163 | 152 | Freeport-McMoRan Oil and Gas Royalty Trust | 29,648 | 115 | [58]24,705 | 52 | 24,221 | 123 | [40]26,596 | — | NA |
| 164 | 165 | Coda Energy Inc.[29,59] | 29,076 | 147 | 13,770 | 118 | 1,170 | 199 | 7,957 | 159 | 2,438 |
| 165 | 184 | Petroleum Development Corp. | 28,690 | 166 | 10,233 | 333 | (768) | 178 | 9,944 | 181 | 1,350 |
| 166 | 169 | Enex Resources Corp.[60] | 27,387 | 175 | 8,866 | 373 | (4,226) | 127 | 25,226 | 194 | 1,106 |
| 167 | 182 | MSR Exploration Ltd.[61] | 27,145 | 220 | 3,505 | 264 | (116) | 136 | 21,599 | 267 | 289 |
| 168 | 168 | Callon Consolidated Partners L.P. | 26,618 | 148 | 13,704 | 112 | 1,483 | 137 | [11]20,938 | 274 | 252 |
| 169 | 189 | Blue Dolphin Energy Co.[62] | 26,409 | 198 | 5,398 | 358 | (1,855) | 188 | 8,664 | 275 | 247 |
| 170 | 196 | Convest Energy Partners Ltd. | 26,250 | 164 | 10,858 | 94 | 2,580 | 134 | [11]22,614 | 134 | 4,707 |
| 171 | 205 | Resource America Inc.[10,63] | 26,150 | 180 | 7,984 | 105 | 1,650 | 133 | 22,628 | 186 | 1,256 |
| 172 | 276 | Wichita River Oil Corp. | 25,968 | 225 | 3,338 | 348 | (1,409) | 223 | 5,032 | 284 | 206 |
| 173 | 195 | Barrett Resources Corp.[10] | 25,814 | 187 | 6,445 | 121 | 1,112 | 147 | 17,625 | 143 | 3,720 |
| 174 | 190 | Belden & Blake Energy Co. | 25,442 | 163 | 11,035 | 346 | (1,294) | 157 | [11]14,735 | 216 | 715 |
| 175 | 174 | Paine Webber/Geodyne Energy Income L.P. I-E | 25,285 | 161 | 11,072 | 84 | 3,290 | 129 | [11]24,826 | 232 | 541 |
| 176 | — | Enercap Corp. | 25,149 | 275 | 1,452 | 371 | (3,687) | 244 | 3,654 | 155 | 2,786 |
| 177 | 175 | Paine Webber/Geodyne Energy Income L.P. II-D | 24,495 | 192 | 5,941 | 334 | (784) | 130 | [11]24,373 | 207 | 871 |
| 178 | 179 | Tipperary Corp.[10] | 24,349 | 141 | 15,792 | 352 | (1,519) | 387 | (5,680) | 234 | 529 |
| 179 | 187 | Deminex U.S. Oil Co.[64] | 24,140 | 138 | 16,000 | 92 | 2,829 | 181 | 9,614 | 136 | 4,472 |
| 180 | 177 | Paine Webber/Geodyne Energy Income L.P. II-B | 23,515 | 169 | 9,696 | 184 | 119 | 132 | [11]23,515 | 238 | 504 |
| 181 | 210 | Sunlite Inc.[29] | 22,216 | 160 | 11,543 | 85 | 3,212 | 145 | 18,246 | 132 | 5,107 |
| 182 | 211 | Petroleum Investments, Ltd. | 22,212 | 183 | 7,304 | 366 | (3,252) | 194 | [11]8,132 | 171 | 1,970 |
| 183 | 188 | Prudential-Bache Energy Income L.P. II P-8 | 21,023 | 197 | 5,442 | 174 | 203 | 142 | [11]18,751 | 337 | 42 |
| 184 | 203 | Belcor Inc.[65] | 20,804 | 113 | 26,466 | 123 | 1,066 | 204 | 7,366 | 183 | 1,307 |
| 185 | 201 | Hershey Oil Corp. | 20,514 | 189 | 6,378 | 343 | (1,184) | 168 | 11,559 | 144 | 3,547 |
| 186 | 191 | Prudential-Bache Energy Income L.P. II P-10 | 20,288 | 204 | 4,825 | 155 | 481 | 144 | 18,364 | 350 | 29 |
| 187 | 183 | DI Industries, Inc.[44] | 20,031 | 177 | 8,459 | 370 | (3,455) | 166 | [11]12,960 | 248 | 403 |
| 188 | 212 | Caspen Oil Inc.[66] | 19,955 | 182 | 7,673 | 173 | 205 | 197 | 7,987 | 110 | 10,874 |
| 189 | 197 | Columbus Energy Corp.[67] | 19,596 | 173 | 9,242 | 367 | (3,293) | 208 | 6,381 | 169 | 2,054 |
| 190 | 209 | Red Eagle Resources Corp.[11] | 19,444 | 125 | 20,298 | 191 | 99 | 182 | 9,519 | 137 | 4,461 |
| 191 | 198 | Paine Webber/Geodyne Energy Income L.P. II-E | 19,320 | 212 | 3,913 | 172 | 225 | 141 | [11]19,280 | 126 | 6,307 |
| 192 | 217 | Adams Resources & Energy Inc. | 18,284 | 81 | 89,717 | 102 | 1,916 | 272 | 2,281 | 175 | 1,793 |
| 193 | 200 | Baruch-Foster Corp. | 17,442 | 174 | 8,905 | 296 | (272) | 183 | 9,490 | 173 | 1,812 |
| 194 | 199 | LL & E Royalty Trust | 16,876 | 157 | 12,467 | 66 | [58]11,537 | 152 | [40]16,876 | — | NA |
| 195 | 202 | Prudential-Bache Energy Income L.P. II P-11 | 16,846 | 214 | 3,891 | 131 | 918 | 155 | [11]15,311 | 364 | 23 |
| 196 | 208 | Pan Petroleum MLP | 16,437 | 219 | 3,506 | 219 | 6 | 162 | [11]13,954 | 239 | 484 |
| 197 | 270 | Plexus Resources Corp.[29] | 16,230 | 328 | 611 | 344 | (1,199) | 291 | 1,816 | 341 | 38 |
| 198 | 204 | Tucker Drilling Co. Inc.[44] | 16,094 | 152 | 13,007 | 349 | (1,444) | 158 | 14,652 | 150 | 3,109 |
| 199 | 219 | Hallador Petroleum Co.[68] | 15,962 | 230 | 3,128 | 337 | (846) | 195 | 8,067 | 222 | 646 |
| 200 | 243 | Evergreen Resources Inc.[69] | 15,429 | 224 | 3,350 | 253 | (55) | 160 | 14,249 | 195 | 1,085 |
| 201 | — | American International Petroleum Corp. | 15,113 | 120 | 21,706 | 381 | (11,288) | 324 | 1,089 | 220 | 673 |
| 202 | 231 | Arch Petroleum Inc.[65] | 15,076 | 196 | 5,493 | 111 | 1,500 | 243 | 3,875 | 135 | 4,564 |
| 203 | 221 | Thor Energy Resources Inc.[13] | 13,889 | 213 | 3,898 | 238 | (19) | 203 | 7,723 | 154 | 2,808 |
| 204 | — | NY Life Oil&Gas Producing Properties II-G,L.P. | 13,696 | 241 | 2,322 | 263 | (108) | 165 | [11]13,544 | 108 | 11,624 |

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 175 | 0.119 | 199 | 0.814 | 130 | 2.157 | 207 | 8.509 | 172 | 0.119 | 194 | 0.814 | 126 | 2.157 | 202 | 8.509 | 142 | 1.918 |
| 188 | 0.098 | 362 | 0.034 | 123 | 2.491 | 374 | 0.123 | 334 | 0.009 | 361 | 0.034 | 357 | 0.027 | 374 | 0.123 | — | 0 |
| 172 | 0.120 | 173 | 1.399 | 260 | 0.277 | 162 | 18.21 | 168 | 0.120 | 170 | 1.399 | 254 | 0.277 | 159 | 18.21 | 129 | 2.430 |
| 118 | 0.320 | 214 | 0.577 | 135 | 2.013 | 83 | 91.24 | 114 | 0.320 | 209 | 0.577 | 131 | 2.013 | 75 | 91.24 | 140 | 2.000 |
| 170 | 0.125 | 168 | 1.581 | 198 | 0.824 | 150 | 21.17 | 165 | 0.125 | 164 | 1.581 | 191 | 0.824 | 147 | 21.17 | — | NA |
| 273 | 0.031 | 170 | 1.511 | 274 | 0.229 | 180 | 14.06 | 269 | 0.031 | 167 | 1.511 | 270 | 0.229 | 177 | 14.06 | 98 | 5.310 |
| 125 | 0.275 | 116 | 3.928 | 155 | 1.479 | 151 | 20.52 | 122 | 0.275 | 114 | 3.928 | 148 | 1.479 | 148 | 20.52 | — | NA |
| 197 | 0.092 | 167 | 1.589 | 127 | 2.197 | 159 | 19.09 | 191 | 0.092 | 163 | 1.589 | 123 | 2.197 | 156 | 19.09 | 164 | 1.192 |
| 148 | 0.177 | 152 | 1.894 | 163 | 1.299 | 153 | 20.08 | 145 | 0.177 | 150 | 1.894 | 156 | 1.299 | 150 | 20.08 | — | 0 |
| 179 | 0.114 | 81 | 10.40 | 295 | 0.160 | 152 | 20.36 | 176 | 0.114 | 75 | 10.40 | 292 | 0.160 | 149 | 20.36 | — | NA |
| 141 | 0.204 | 141 | 2.296 | 208 | 0.727 | 192 | 11.30 | 139 | 0.204 | 140 | 2.296 | 202 | 0.727 | 188 | 11.30 | 227 | 2.000 |
| 316 | 0.017 | 209 | 0.619 | 298 | 0.151 | 148 | 21.23 | 313 | 0.017 | 204 | 0.619 | 296 | 0.151 | 145 | 21.23 | 141 | 1.990 |
| 145 | 0.181 | 142 | 2.290 | 192 | 0.900 | 172 | 15.56 | 142 | 0.181 | 141 | 2.290 | 186 | 0.900 | 169 | 15.56 | 118 | 3.093 |
| 169 | 0.126 | 338 | 0.067 | 115 | 3.127 | 200 | 10.55 | 164 | 0.126 | 353 | 0.040 | 109 | 3.116 | 238 | 4.319 | — | NA |
| 99 | 0.552 | 161 | 1.726 | 120 | 2.793 | 205 | 8.562 | 90 | 0.552 | 158 | 1.726 | 114 | 2.793 | 200 | 8.562 | 209 | 0.230 |
| 205 | 0.085 | 190 | 0.994 | 213 | 0.647 | 157 | 19.40 | 200 | 0.085 | 186 | 0.994 | 207 | 0.647 | 154 | 19.40 | — | 0 |
| 120 | 0.291 | 171 | 1.499 | 119 | 2.855 | 184 | 12.79 | 116 | 0.291 | 168 | 1.499 | 113 | 2.855 | 181 | 12.79 | 102 | 4.530 |
| 250 | 0.042 | 180 | 1.285 | 284 | 0.198 | 209 | 8.437 | 245 | 0.042 | 177 | 1.285 | 281 | 0.198 | 204 | 8.437 | 163 | 1.200 |
| 177 | 0.118 | 235 | 0.419 | 111 | 3.651 | 138 | 26.73 | 174 | 0.118 | 232 | 0.419 | 104 | 3.651 | 133 | 26.73 | — | 0 |
| 258 | 0.038 | 156 | 1.802 | 285 | 0.197 | 131 | 28.52 | 251 | 0.038 | 153 | 1.802 | 282 | 0.197 | 126 | 28.52 | 80 | 9.250 |
| 113 | 0.359 | 163 | 1.718 | 132 | 2.111 | 181 | 13.71 | 107 | 0.359 | 160 | 1.718 | 128 | 2.111 | 178 | 13.71 | 90 | 6.800 |
| 149 | 0.176 | 110 | 4.457 | 189 | 0.932 | 139 | 26.27 | 146 | 0.176 | 108 | 4.457 | 183 | 0.932 | 134 | 26.27 | — | NA |
| 219 | 0.073 | — | 0 | 47 | 21.66 | — | 0 | 214 | 0.073 | — | 0 | 41 | 21.66 | — | 0 | — | NA |
| 139 | 0.209 | 128 | 2.960 | 188 | 0.943 | 164 | 17.63 | 137 | 0.209 | 126 | 2.960 | 182 | 0.943 | 161 | 17.63 | — | NA |
| 133 | 0.232 | 176 | 1.345 | 114 | 3.167 | 140 | 24.90 | 131 | 0.232 | 173 | 1.345 | 108 | 3.167 | 136 | 24.90 | 218 | 0.130 |
| 95 | 0.633 | 131 | 2.782 | 96 | 4.840 | 149 | 21.22 | 88 | 0.633 | 129 | 2.782 | 88 | 4.840 | 146 | 21.22 | 87 | 7.700 |
| 130 | 0.246 | 130 | 2.848 | 182 | 1.048 | 170 | 16.02 | 127 | 0.246 | 128 | 2.848 | 174 | 1.048 | 167 | 16.02 | — | NA |
| 237 | 0.052 | 200 | 0.788 | 224 | 0.523 | 191 | 11.55 | 288 | 0.023 | 275 | 0.162 | 248 | 0.300 | 242 | 3.892 | — | 0 |
| 173 | 0.120 | 129 | 2.942 | 217 | 0.598 | 166 | 16.57 | 169 | 0.120 | 127 | 2.942 | 211 | 0.598 | 163 | 16.57 | 146 | 1.700 |
| 194 | 0.093 | 165 | 1.629 | 231 | 0.459 | 129 | 28.87 | 188 | 0.093 | 162 | 1.629 | 225 | 0.459 | 124 | 28.87 | — | 0 |
| 244 | 0.047 | 329 | 0.081 | 277 | 0.215 | 350 | 0.412 | 237 | 0.047 | 327 | 0.081 | 273 | 0.215 | 349 | 0.412 | — | 0 |
| 184 | 0.103 | 151 | 2.062 | 197 | 0.844 | 92 | 65.54 | 183 | 0.099 | 254 | 0.272 | 194 | 0.773 | 307 | 1.274 | 216 | 0.150 |
| 220 | 0.067 | 179 | 1.306 | 215 | 0.622 | 119 | 31.99 | 216 | 0.067 | 176 | 1.306 | 209 | 0.622 | 116 | 31.99 | — | 0 |
| 309 | 0.018 | 227 | 0.486 | 292 | 0.173 | 242 | 4.446 | 304 | 0.018 | 224 | 0.486 | 289 | 0.173 | 237 | 4.446 | 214 | 0.160 |
| 186 | 0.102 | 124 | 3.120 | 273 | 0.231 | 177 | 14.33 | 181 | 0.102 | 121 | 3.120 | 269 | 0.231 | 174 | 14.33 | 194 | 0.490 |
| 150 | 0.170 | 153 | 1.893 | 139 | 1.824 | 128 | 28.91 | 171 | 0.119 | 235 | 0.406 | 162 | 1.152 | 207 | 7.224 | 225 | 0.070 |
| 180 | 0.114 | 137 | 2.551 | 242 | 0.373 | 218 | 6.724 | 177 | 0.114 | 135 | 2.551 | 235 | 0.373 | 213 | 6.724 | 103 | 4.400 |
| 171 | 0.122 | 172 | 1.454 | 203 | 0.750 | 178 | 14.31 | 167 | 0.122 | 169 | 1.454 | 197 | 0.750 | 175 | 14.31 | — | NA |
| 241 | 0.048 | 216 | 0.562 | 297 | 0.155 | 274 | 2.496 | 235 | 0.048 | 212 | 0.562 | 294 | 0.155 | 272 | 2.496 | — | NA |
| 117 | 0.324 | 158 | 1.768 | 116 | 3.089 | 182 | 13.13 | 112 | 0.324 | 155 | 1.768 | 110 | 3.089 | 179 | 13.13 | 154 | 1.460 |
| 100 | 0.544 | 155 | 1.805 | 109 | 3.769 | 195 | 10.89 | 91 | 0.544 | 152 | 1.805 | 102 | 3.769 | 191 | 10.89 | 148 | 1.600 |
| 234 | 0.053 | 189 | 1.052 | 228 | 0.489 | 135 | 27.25 | 229 | 0.053 | 185 | 1.052 | 221 | 0.489 | 130 | 27.25 | — | 0 |
| 195 | 0.093 | 188 | 1.059 | 174 | 1.120 | 161 | 18.53 | 190 | 0.093 | 184 | 1.059 | 168 | 1.120 | 158 | 18.53 | 150 | 1.518 |
| 355 | 0.004 | 302 | 0.119 | 346 | 0.046 | 261 | 2.932 | 354 | 0.004 | 301 | 0.119 | 343 | 0.046 | 258 | 2.932 | — | 0 |
| 319 | 0.015 | 254 | 0.299 | 342 | 0.057 | 313 | 0.941 | 316 | 0.015 | 252 | 0.299 | 339 | 0.057 | 312 | 0.941 | 132 | 2.060 |
| 203 | 0.087 | 187 | 1.078 | 214 | 0.638 | 189 | 11.64 | 198 | 0.087 | 183 | 1.078 | 208 | 0.638 | 186 | 11.64 | 144 | 1.860 |
| 191 | 0.095 | 240 | 0.375 | 121 | 2.767 | 199 | 10.63 | 185 | 0.095 | 238 | 0.375 | 115 | 2.767 | 193 | 10.63 | — | 0 |
| 334 | 0.009 | 274 | 0.187 | 160 | 1.394 | 215 | 6.878 | 331 | 0.009 | 273 | 0.187 | 264 | 0.253 | 210 | 6.878 | — | NA |
| 147 | 0.177 | 185 | 1.084 | 102 | 4.140 | 125 | 29.18 | 144 | 0.177 | 182 | 1.084 | 94 | 4.140 | 121 | 29.18 | — | NA |
| 217 | 0.074 | 201 | 0.781 | 223 | 0.558 | 194 | 10.93 | 211 | 0.074 | 195 | 0.781 | 217 | 0.558 | 190 | 10.93 | 172 | 0.940 |
| 236 | 0.052 | 222 | 0.527 | 225 | 0.522 | 234 | 5.381 | 231 | 0.052 | 218 | 0.527 | 218 | 0.522 | 228 | 5.381 | — | NA |

| Rank by total assets — 1989 | Rank by total assets — 1988 | Company | Total assets $000 | Total revenue — Rank | Total revenue — $000 | Net income — Rank | Net income — $000 | Stockholders' equity — Rank | Stockholders' equity — $000 | Capital & Expl. spending — Rank | Capital & Expl. spending — $000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 205 | 215 | Brock Exploration Corp.[44] | 13,685 | 176 | 8,588 | 117 | 1,194 | 231 | 4,565 | 156 | 2,780 |
| 206 | 224 | Energy Assets International Corp. | 13,610 | 199 | 5,360 | 355 | (1,619) | 187 | 8,824 | 189 | 1,171 |
| 207 | 311 | K.R.M. Petroleum Corp. | 13,218 | 193 | 5,925 | 126 | 1,012 | 220 | 5,330 | 177 | 1,764 |
| 208 | 233 | Nahama & Weagant Energy Co.[13] | 12,979 | 270 | 1,524 | 203 | 49 | 184 | 9,388 | 160 | 2,435 |
| 209 | 214 | NY Life Oil&Gas Producing Properties II-D,L.P. | 12,896 | 205 | 4,729 | 341 | (1,092) | 170 | [11]11,242 | 223 | 638 |
| 210 | 216 | Prudential-Bache Energy Income L.P. II P-9 | 12,793 | 226 | 3,296 | 201 | 56 | 169 | [11]11,420 | 363 | 23 |
| 211 | 222 | Dorchester Hugoton, Ltd. | 12,661 | 194 | 5,853 | 90 | 2,862 | 172 | [11]10,907 | 184 | 1,293 |
| 212 | 242 | Falcon Oil & Gas Co., Inc.[13] | 12,489 | 232 | 3,048 | 140 | 705 | 202 | 7,911 | 139 | 4,415 |
| 213 | 229 | The Home-Stake Royalty Corp. | 12,478 | 195 | 5,541 | 113 | 1,383 | 177 | 10,312 | 158 | 2,610 |
| 214 | 226 | Vermilion Bay Land Co.[44,70] | 12,167 | 215 | 3,779 | 138 | 725 | 175 | 10,722 | 180 | 1,531 |
| 215 | 253 | Whiting Petroleum Corp. | 11,973 | 202 | 4,875 | 104 | 1,668 | 193 | 8,160 | 146 | 3,453 |
| 216 | 263 | Prima Energy Corp.[29] | 11,436 | 210 | 4,059 | 149 | 581 | 192 | 8,364 | 209 | 833 |
| 217 | 223 | Sabine Royalty Trust | 11,142 | 121 | 21,258 | 58 | 19,877 | 176 | [40]10,513 | — | 0 |
| 218 | — | NY Life Oil&Gas Producing Properties II-E, L.P. | 11,076 | 233 | 2,928 | 176 | 173 | 171 | [11]10,927 | 111 | 10,632 |
| 219 | 220 | Paine Webber/Geodyne Energy Income L.P., II-C | 10,890 | 217 | 3,557 | 183 | 136 | 173 | [11]10,890 | 277 | 242 |
| 220 | 165 | Normandy Oil and Gas Co. Inc.[29] | 10,362 | 262 | 1,795 | 302 | (317) | 232 | 4,470 | 162 | 2,334 |
| 221 | 235 | Prudential-Bache Energy Income L.P. II P-7 | 10,126 | 223 | 3,359 | 136 | 752 | 190 | [11]8,580 | 370 | 16 |
| 222 | 238 | Bellwether Exploration Co.[29] | 10,071 | 234 | 2,912 | 159 | 416 | 180 | 9,647 | 176 | 1,776 |
| 223 | 236 | Prudential-Bache Energy Income L.P. II P-4 | 9,783 | 228 | 3,226 | 150 | 572 | 196 | [11]8,014 | 334 | 45 |
| 224 | 266 | Eglinton Oil & Gas Corp.[71] | 9,375 | 281 | 1,256 | 180 | 147 | 389 | [72](12,357) | 153 | 2,821 |
| 225 | 240 | Prudential-Bache Energy Income L.P. II P-5 | 9,267 | 244 | 2,246 | 227 | (3) | 200 | [11]7,955 | 343 | 35 |
| 226 | 228 | Columbian Energy Co. L.P.[10] | 9,125 | 259 | 1,900 | 360 | (2,067) | 189 | [11]8,657 | 303 | 113 |
| 227 | 251 | Credo Petroleum Corp.[65] | 9,057 | 263 | 1,701 | 156 | 475 | 198 | 7,975 | 217 | 714 |
| 228 | 249 | Permian Basin Royalty Trust | 8,821 | 118 | 21,980 | 56 | 21,623 | 210 | [40]6,327 | — | NA |
| 229 | 252 | The Home-Stake Oil & Gas Co. | 8,786 | 203 | 4,840 | 129 | 981 | 205 | 7,220 | 167 | 2,179 |
| 230 | 237 | Paine Webber/Geodyne Energy Income L.P. I-F | 8,664 | 208 | 4,419 | 116 | 1,214 | 191 | [11]8,491 | 278 | 236 |
| 231 | 244 | Striker Petroleum Corp. | 8,256 | 274 | 1,473 | 336 | (805) | 222 | 5,042 | 281 | 220 |
| 232 | 246 | Petrominerals Corp. | 8,127 | 188 | 6,439 | 281 | (198) | 213 | 5,764 | 254 | 377 |
| 233 | 248 | Z G Energy Corp. | 7,967 | 191 | 5,946 | 179 | 148 | 345 | 638 | 206 | 886 |
| 234 | 247 | Prudential-Bache Pension & Retirement L.P. PBR-3 | 7,935 | 279 | 1,320 | 170 | 258 | 201 | [11]7,935 | 338 | 41 |
| 235 | 290 | HarCor Energy Inc. | 7,802 | 251 | 2,079 | 326 | (615) | 250 | 3,523 | 293 | 157 |
| 236 | 250 | Prudential-Bache Energy Income Fund 1983 P-3 | 7,545 | 211 | 4,020 | 120 | 1,121 | 246 | [11]3,743 | 330 | 50 |
| 237 | 258 | Omni Exploration Inc.[10] | 7,354 | 253 | 2,067 | 287 | (235) | 229 | 4,775 | 245 | 413 |
| 238 | 302 | Greenwood Holdings Inc. | 7,319 | 258 | 1,904 | 266 | (119) | 206 | 6,821 | 250 | 397 |
| 239 | 261 | Habersham Energy Co.[10,73] | 7,244 | 256 | 1,949 | 277 | (166) | 261 | 2,875 | 191 | 1,145 |
| 240 | 260 | Panhandle Royalty Co.[10] | 7,230 | 239 | 2,466 | 160 | 403 | 216 | 5,657 | 210 | 808 |
| 241 | 245 | Prudential-Bache Energy Income L.P. II P-6 | 7,221 | 227 | 3,255 | 300 | (313) | 214 | [11]5,729 | 327 | 54 |
| 242 | — | Tide West Oil Co.[56] | 6,972 | 250 | 2,079 | 141 | 705 | 264 | 2,764 | 326 | 54 |
| 243 | 239 | Premier Resources Ltd.[10] | 6,945 | 235 | 2,873 | 225 | (1) | 301 | 1,551 | 295 | 148 |
| 244 | 267 | Lomak Petroleum Inc.[74] | 6,882 | 201 | 4,929 | 188 | 103 | 328 | 1,044 | 187 | 1,247 |
| 245 | 286 | Gold King Consolidated Inc. | 6,816 | 294 | 948 | 306 | (357) | 212 | 5,909 | 172 | 1,832 |
| 246 | 262 | Prudential-Bache Energy Income Fund 1983 P-2 | 6,785 | 218 | 3,516 | 128 | 982 | 247 | [11]3,659 | 329 | 51 |
| 247 | 268 | NY Life Oil&Gas Producing Properties II-A, L.P. | 6,633 | 231 | 3,063 | 107 | 1,591 | 207 | [11]6,512 | 263 | 300 |
| 248 | 284 | Golden Oil Co. | 6,605 | 283 | 1,218 | 327 | (654) | 221 | 5,322 | 255 | 367 |
| 249 | 256 | NY Life Oil&Gas Producing Properties II-B, L.P. | 6,545 | 249 | 2,084 | 163 | 347 | 209 | [11]6,356 | 235 | 525 |
| 250 | 271 | GeoResources Inc. | 6,203 | 243 | 2,289 | 187 | 112 | 239 | 4,021 | 258 | 341 |
| 251 | 225 | Gulf Exploration Consultants Inc. | 6,143 | 238 | 2,605 | 372 | (3,946) | 329 | 979 | — | 0 |
| 252 | — | Reserve Petroleum Co. | 6,041 | 269 | 1,627 | 161 | 384 | 217 | 5,618 | 228 | 569 |
| 253 | 292 | Churchill Technology, Inc.[10] | 5,989 | 299 | 924 | 330 | (687) | 277 | 2,131 | 340 | 39 |
| 254 | 264 | Prudential-Bache Pension & Retirement L.P. PBR-4 | 5,947 | 272 | 1,494 | 164 | 345 | 211 | [11]5,944 | 328 | 53 |
| 255 | 234 | Cobb Resources Corp.[29] | 5,925 | 248 | 2,093 | 374 | (5,516) | 256 | 3,221 | 225 | 606 |

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 164 | 0.137 | 157 | 1.787 | 216 | 0.617 | 168 | 16.45 | 158 | 0.137 | 154 | 1.787 | 210 | 0.617 | 165 | 16.45 | 186 | 0.547 |
| 252 | 0.041 | 164 | 1.685 | 272 | 0.234 | 163 | 17.76 | 247 | 0.041 | 161 | 1.685 | 268 | 0.234 | 160 | 17.76 | — | NA |
| 192 | 0.094 | 223 | 0.518 | 207 | 0.727 | 212 | 7.990 | 187 | 0.094 | 219 | 0.518 | 201 | 0.727 | 206 | 7.990 | 151 | 1.500 |
| 260 | 0.038 | 258 | 0.263 | 205 | 0.742 | 230 | 5.455 | 252 | 0.038 | 257 | 0.263 | 199 | 0.742 | 224 | 5.455 | 110 | 3.730 |
| 165 | 0.132 | 182 | 1.206 | 193 | 0.890 | 210 | 8.339 | 159 | 0.132 | 179 | 1.206 | 187 | 0.890 | 205 | 8.339 | — | NA |
| 231 | 0.056 | 191 | 0.984 | 259 | 0.278 | 165 | 17.38 | 226 | 0.056 | 187 | 0.984 | 253 | 0.278 | 162 | 17.38 | — | 0 |
| — | 0 | 82 | 8.387 | — | 0 | 71 | 138.2 | — | 0 | 78 | 8.387 | — | 0 | 63 | 138.2 | — | 0 |
| 214 | 0.075 | 193 | 0.939 | 201 | 0.772 | 141 | 24.66 | 209 | 0.075 | 189 | 0.939 | 195 | 0.772 | 137 | 24.66 | — | 0 |
| 155 | 0.162 | 178 | 1.319 | 173 | 1.128 | 186 | 12.43 | 150 | 0.162 | 175 | 1.319 | 167 | 1.128 | 183 | 12.43 | 126 | 2.590 |
| 185 | 0.103 | 213 | 0.577 | 200 | 0.780 | 241 | 4.487 | 179 | 0.103 | 210 | 0.577 | 193 | 0.780 | 236 | 4.487 | 160 | 1.320 |
| 200 | 0.089 | 203 | 0.755 | 172 | 1.135 | 220 | 6.576 | 196 | 0.089 | 197 | 0.755 | 166 | 1.135 | 214 | 6.576 | — | 0 |
| 271 | 0.033 | 236 | 0.419 | 194 | 0.889 | 179 | 14.19 | 267 | 0.033 | 233 | 0.419 | 188 | 0.889 | 176 | 14.19 | 152 | 1.500 |
| 84 | 0.737 | 92 | 6.313 | 87 | 5.884 | 113 | 40.68 | 79 | 0.737 | 90 | 6.313 | 79 | 5.884 | 109 | 40.68 | — | 0 |
| 216 | 0.074 | 221 | 0.534 | 232 | 0.459 | 239 | 4.735 | 212 | 0.074 | 217 | 0.534 | 224 | 0.459 | 234 | 4.735 | — | NA |
| 204 | 0.086 | 181 | 1.270 | 248 | 0.351 | 206 | 8.524 | 199 | 0.086 | 178 | 1.270 | 241 | 0.351 | 201 | 8.524 | — | NA |
| 274 | 0.031 | 224 | 0.508 | 222 | 0.576 | 213 | 7.104 | 268 | 0.031 | 220 | 0.508 | 216 | 0.576 | 208 | 7.104 | — | 0 |
| 196 | 0.092 | 206 | 0.655 | 190 | 0.927 | 173 | 15.17 | 192 | 0.092 | 201 | 0.655 | 184 | 0.927 | 170 | 15.17 | — | 0 |
| 223 | 0.065 | 204 | 0.722 | 218 | 0.597 | 221 | 6.493 | 218 | 0.065 | 198 | 0.722 | 212 | 0.597 | 215 | 6.493 | 199 | 0.410 |
| 157 | 0.151 | 242 | 0.362 | 156 | 1.477 | 243 | 4.153 | 152 | 0.151 | 240 | 0.362 | 149 | 1.477 | 239 | 4.153 | — | 0 |
| 232 | 0.055 | 327 | 0.081 | 154 | 1.488 | 270 | 2.617 | 227 | 0.055 | 326 | 0.081 | 147 | 1.488 | 268 | 2.617 | 120 | 3.000 |
| 169 | 0.098 | 250 | 0.313 | 183 | 1.045 | 254 | 3.634 | 184 | 0.098 | 248 | 0.313 | 175 | 1.045 | 251 | 3.634 | — | 0 |
| 224 | 0.063 | 220 | 0.537 | 199 | 0.799 | 225 | 6.289 | 219 | 0.063 | 216 | 0.537 | 192 | 0.799 | 219 | 6.289 | — | 0 |
| 259 | 0.038 | 253 | 0.301 | 254 | 0.301 | 247 | 3.840 | 254 | 0.038 | 251 | 0.301 | 247 | 0.301 | 244 | 3.840 | 189 | 0.531 |
| 68 | 1.091 | 118 | 3.589 | 56 | 14.89 | 109 | 42.33 | 63 | 1.091 | 116 | 3.589 | 48 | 14.89 | 104 | 42.33 | — | 0 |
| 159 | 0.149 | 183 | 1.178 | 186 | 0.967 | 190 | 11.62 | 154 | 0.149 | 180 | 1.178 | 180 | 0.967 | 187 | 11.62 | 130 | 2.320 |
| 199 | 0.091 | 174 | 1.358 | 230 | 0.473 | 228 | 6.055 | 193 | 0.091 | 171 | 1.358 | 223 | 0.473 | 222 | 6.055 | — | NA |
| 238 | 0.050 | 238 | 0.379 | 148 | 1.557 | 264 | 2.818 | 232 | 0.050 | 236 | 0.379 | 142 | 1.557 | 262 | 2.818 | 179 | 0.800 |
| 158 | 0.150 | 303 | 0.118 | 147 | 1.641 | 325 | 0.669 | 153 | 0.150 | 302 | 0.118 | 140 | 1.641 | 325 | 0.669 | — | 0 |
| 154 | 0.162 | 229 | 0.436 | 169 | 1.151 | 245 | 3.895 | 149 | 0.162 | 226 | 0.436 | 163 | 1.151 | 241 | 3.895 | — | 0 |
| 245 | 0.047 | 218 | 0.548 | 250 | 0.326 | 232 | 5.388 | 239 | 0.047 | 214 | 0.548 | 243 | 0.326 | 226 | 5.388 | — | 0 |
| 198 | 0.091 | 248 | 0.330 | 185 | 0.987 | 280 | 2.184 | 194 | 0.091 | 247 | 0.330 | 178 | 0.987 | 278 | 2.184 | 203 | 0.360 |
| 143 | 0.193 | 264 | 0.247 | 128 | 2.185 | 286 | 2.008 | 141 | 0.193 | 263 | 0.247 | 124 | 2.185 | 284 | 2.008 | — | 0 |
| 207 | 0.082 | 228 | 0.458 | 149 | 1.528 | 134 | 27.76 | 202 | 0.082 | 225 | 0.458 | 143 | 1.528 | 129 | 27.76 | 187 | 0.540 |
| 247 | 0.045 | 239 | 0.376 | 281 | 0.207 | 284 | 2.099 | 241 | 0.045 | 237 | 0.376 | 278 | 0.207 | 282 | 2.099 | 213 | 0.180 |
| 226 | 0.061 | 231 | 0.430 | 206 | 0.735 | 240 | 4.716 | 220 | 0.061 | 228 | 0.430 | 200 | 0.735 | 235 | 4.716 | 177 | 0.812 |
| 268 | 0.035 | 184 | 1.110 | 301 | 0.144 | 223 | 6.468 | 263 | 0.035 | 181 | 1.110 | 298 | 0.144 | 217 | 6.468 | 184 | 0.588 |
| 168 | 0.127 | 219 | 0.544 | 166 | 1.213 | 281 | 2.149 | 163 | 0.127 | 215 | 0.544 | 158 | 1.213 | 279 | 2.149 | — | 0 |
| 235 | 0.053 | 259 | 0.256 | 267 | 0.255 | 289 | 1.833 | 230 | 0.053 | 258 | 0.256 | 261 | 0.255 | 287 | 1.833 | 145 | 1.724 |
| 181 | 0.108 | 194 | 0.934 | 210 | 0.686 | 188 | 11.83 | 344 | 0.007 | 200 | 0.690 | 329 | 0.079 | 197 | 9.265 | 220 | 0.113 |
| 328 | 0.012 | 244 | 0.355 | 338 | 0.063 | 278 | 2.247 | 325 | 0.012 | 242 | 0.355 | 335 | 0.063 | 276 | 2.247 | 157 | 1.400 |
| 310 | 0.018 | 341 | 0.062 | 240 | 0.378 | 315 | 0.859 | 311 | 0.018 | 338 | 0.062 | 233 | 0.378 | 315 | 0.859 | 183 | 0.590 |
| 152 | 0.169 | 273 | 0.189 | 138 | 1.871 | 287 | 1.900 | 148 | 0.169 | 272 | 0.189 | 133 | 1.871 | 285 | 1.900 | — | 0 |
| 222 | 0.066 | 226 | 0.489 | 233 | 0.454 | 256 | 3.555 | 217 | 0.066 | 223 | 0.489 | 226 | 0.454 | 254 | 3.555 | — | NA |
| 246 | 0.046 | 284 | 0.160 | 146 | 1.671 | 300 | 1.487 | 240 | 0.046 | 283 | 0.160 | 139 | 1.671 | 298 | 1.487 | — | 0 |
| 243 | 0.047 | 243 | 0.356 | 261 | 0.271 | 263 | 2.852 | 238 | 0.047 | 241 | 0.356 | 255 | 0.271 | 261 | 2.852 | — | NA |
| 208 | 0.082 | — | 0 | 184 | 1.000 | 370 | 0.219 | 203 | 0.082 | — | 0 | 177 | 1.000 | 370 | 0.219 | 139 | 2.000 |
| 228 | 0.057 | 208 | 0.629 | 391 | 0.001 | 276 | 2.462 | 224 | 0.057 | 203 | 0.629 | 390 | 0.001 | 274 | 2.462 | 169 | 1.000 |
| 331 | 0.011 | 245 | 0.345 | 343 | 0.055 | 290 | 1.822 | 328 | 0.011 | 243 | 0.345 | 340 | 0.055 | 288 | 1.822 | 161 | 1.280 |
| 291 | 0.024 | 294 | 0.137 | 191 | 0.911 | 227 | 6.098 | 283 | 0.024 | 293 | 0.137 | 185 | 0.911 | 221 | 6.098 | 178 | 0.800 |
| 242 | 0.048 | 207 | 0.638 | 243 | 0.369 | 266 | 2.799 | 236 | 0.048 | 202 | 0.638 | 236 | 0.369 | 264 | 2.799 | — | 0 |
| 215 | 0.075 | 306 | 0.110 | 125 | 2.364 | 246 | 3.877 | 210 | 0.075 | 306 | 0.110 | 121 | 2.364 | 243 | 3.877 | 195 | 0.480 |

| Rank by total assets | | | Total assets | Total revenue | | Net income | | Stockholders' equity | | Capital & Expl. spending | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1989 | 1988 | Company | $000 | Rank | $000 | Rank | $000 | Rank | $000 | Rank | $000 |
| 256 | 257 | Nugget Oil Corp.[75] | 5,915 | 254 | 2,010 | 350 | (1,458) | 388 | (6,637) | 244 | 422 |
| 257 | 280 | COM-TEK Resources Inc.[10] | 5,914 | 357 | 355 | 308 | (408) | 224 | 4,961 | 291 | 174 |
| 258 | 277 | Magic Circle Energy Corp. | 5,910 | 237 | 2,640 | 293 | (265) | 234 | 4,393 | 201 | 996 |
| 259 | 272 | NY Life Oil & Gas Producing Properties I-C, Ltd. | 5,839 | 222 | 3,386 | 135 | 774 | 215 | [11]5,701 | 264 | 299 |
| 260 | 275 | Prudential-Bache Energy Income Fund 1983, P-1 | 5,835 | 236 | 2,670 | 146 | 617 | 255 | [11]3,229 | 361 | 24 |
| 261 | 269 | Partners Oil Co. | 5,767 | 268 | 1,647 | 331 | (721) | 273 | 2,281 | 188 | 1,214 |
| 262 | 230 | Daleco Resources Corp.[10,81] | 5,649 | 343 | 491 | 357 | (1,777) | 230 | 4,610 | 260 | 327 |
| 263 | 273 | Mustang Companies, Inc. | 5,644 | 216 | 3,733 | 318 | (530) | 219 | 5,383 | 212 | 774 |
| 264 | 274 | Pyramid Oil Co. | 5,590 | 221 | 3,415 | 324 | (586) | 228 | 4,840 | 282 | 219 |
| 265 | — | NY Life Oil & Gas Producing Properties II-F,L.P. | 5,533 | 277 | 1,388 | 189 | 103 | 218 | [11]5,436 | 133 | 4,796 |
| 266 | 291 | Southern Mineral Corp. | 5,400 | 229 | 3,183 | 130 | 932 | 233 | 4,460 | 148 | 3,356 |
| 267 | 281 | Alta Energy Corp.[29] | 5,338 | 286 | 1,124 | 278 | (173) | 369 | 215 | 311 | 98 |
| 268 | 254 | Sage Drilling Co.[29] | 5,314 | 206 | 4,607 | 363 | (2,693) | 288 | 1,834 | 269 | 271 |
| 269 | 282 | Q E D Exploration, Inc.[66] | 5,259 | 265 | 1,678 | 285 | (217) | 227 | 4,861 | 208 | 851 |
| 270 | — | United Trans-Western, Inc.[76] | 5,059 | 255 | 1,962 | 262 | (108) | 374 | 47 | 165 | 2,317 |
| 271 | 329 | Oxford Consolidated Inc.[44] | 5,048 | 242 | 2,317 | 167 | 311 | 237 | 4,248 | 256 | 292 |
| 272 | 325 | Roxana Resources, Ltd.[77] | 5,015 | 390 | 132 | 309 | (409) | 238 | 4,094 | 166 | 2,292 |
| 273 | 294 | WEXCO of Delaware, Inc.[78] | 4,948 | 293 | 1,011 | 218 | 6 | 254 | 3,242 | 179 | 1,672 |
| 274 | 283 | Houston Oil Royalty Trust[79] | 4,930 | 325 | 621 | 175 | [58]196 | 225 | [40]4,929 | — | NA |
| 275 | 307 | Parallel Petroleum Corp. | 4,881 | 295 | 948 | 205 | 43 | 252 | 3,348 | 190 | 1,171 |
| 276 | 278 | Paine Webber/Geodyne Energy Income L.P. I-B | 4,870 | 289 | 1,062 | 294 | (270) | 226 | [11]4,870 | 346 | 33 |
| 277 | 255 | Trinity Resources Ltd.[80] | 4,803 | 200 | 5,194 | 125 | 1,013 | 235 | 4,285 | 218 | 704 |
| 278 | — | Benton Oil & Gas Co.[81] | 4,514 | 352 | 409 | 315 | (513) | 267 | 2,623 | 204 | 939 |
| 279 | 298 | Woodbine Petroleum Inc.[10] | 4,465 | 266 | 1,660 | 165 | 333 | 257 | 3,216 | 240 | 475 |
| 280 | 306 | Questa Oil & Gas Co. | 4,422 | 246 | 2,195 | 153 | 500 | 281 | 1,952 | 230 | 558 |
| 281 | 287 | Paine Webber/Geodyne Energy Income L.P. I-D | 4,398 | 257 | 1,939 | 145 | 676 | 236 | [11]4,274 | 305 | 112 |
| 282 | 397 | Amber Resources Co. | 4,308 | 301 | 902 | 222 | 2 | 383 | (2,475) | 227 | 592 |
| 283 | 300 | International Basic Resources, Inc.[29] | 4,216 | 384 | 173 | 248 | (38) | 304 | 1,534 | 252 | 387 |
| 284 | 296 | Hawks Industries Inc. | 4,164 | 207 | 4,509 | 169 | 290 | 265 | 2,761 | 285 | 292 |
| 285 | — | Enex Oil & Gas Income Program II-1 | 4,060 | 355 | 374 | 291 | (256) | 251 | [11]3,500 | 359 | 25 |
| 286 | | Pascali Group Inc.[23] | 4,025 | 339 | 540 | 166 | 322 | 308 | 1,488 | 170 | 2,015 |
| 287 | 297 | NY Life Oil & Gas Producing Properties I-A,Ltd. | 4,014 | 240 | 2,275 | 148 | 588 | 242 | [11]3,880 | 290 | 183 |
| 288 | 279 | Basic Earth Science Systems, Inc.[44] | 3,974 | 271 | 1,507 | 284 | (201) | 289 | 1,830 | 261 | 311 |
| 289 | 305 | NY Life Oil & Gas Producing Properties I-D, Ltd. | 3,951 | 260 | 1,884 | 144 | 693 | 241 | [11]3,882 | 294 | 154 |
| 290 | 303 | Dallas Oil & Minerals Inc. | 3,939 | 264 | 1,680 | 239 | (20) | 240 | 3,888 | 233 | 535 |
| 291 | 314 | Great Eastern Energy & Development Corp. | 3,828 | 252 | 2,072 | 154 | 487 | 248 | 3,550 | 246 | 406 |
| 292 | 301 | Prudential-Bache Pension & Retirement L.P. PBR-2 | 3,764 | 331 | 585 | 199 | 72 | 245 | [11]3,764 | — | 0 |
| 293 | 293 | BT Energy Corp.[82] | 3,708 | 245 | 2,231 | 305 | (333) | 327 | 1,026 | 331 | 48 |
| 294 | 309 | Toreador Royalty Corp. | 3,595 | 313 | 740 | 286 | (223) | 249 | 3,545 | 251 | 391 |
| 295 | 310 | Tyrex Oil Co.[29] | 3,487 | 282 | 1,247 | 289 | (243) | 253 | 3,254 | 178 | 1,679 |
| 296 | — | Enex Oil & Gas Income Program II-2 | 3,437 | 358 | 347 | 298 | (287) | 259 | [11]3,074 | 349 | 30 |
| 297 | 308 | NY Life Oil & Gas Producing Properties II-C,L.P. | 3,283 | 291 | 1,042 | 178 | 150 | 258 | [11]3,186 | 271 | 263 |
| 298 | 319 | Pioneer Oil & Gas | 3,185 | 267 | 1,651 | 181 | 143 | 290 | 1,829 | 214 | 737 |
| 299 | — | Enex Oil & Gas Income Prog. III-Series 5, L.P. | 3,098 | 280 | 1,275 | 202 | 49 | 260 | [11]2,889 | 292 | 163 |
| 300 | 304 | Kimco Energy Corp.[29] | 3,025 | 261 | 1,829 | 329 | (666) | 295 | 1,749 | 231 | 550 |
| 301 | — | Bogert 1986 - II L.P. | 2,943 | 288 | 1,085 | 198 | 72 | 262 | [11]2,852 | 366 | 22 |
| 302 | — | Enex Oil & Gas Income Prog. III-Series 8, L.P. | 2,849 | 302 | 895 | 195 | 81 | 266 | [11]2,653 | 316 | 81 |
| 303 | 313 | Vineyard Oil & Gas Co. | 2,824 | 290 | 1,056 | 342 | (1,147) | 382 | (1,937) | 369 | 16 |
| 304 | 312 | Paine Webber/Geodyne Energy Income L.P. I-C | 2,786 | 292 | 1,020 | 279 | (194) | 263 | [11]2,786 | 355 | 27 |
| 305 | — | Enex Oil & Gas Income Prog. IV-Series 3, L.P. | 2,777 | 347 | 452 | 250 | (40) | 268 | [11]2,563 | 347 | 33 |
| 306 | 324 | Robson Petroleum Ltd. | 2,730 | 285 | 1,126 | 220 | 6 | 284 | 1,877 | 243 | 443 |

| Worldwide liquids production |  | Worldwide natural gas production |  | Worldwide liquids reserves |  | Worldwide natural gas reserves |  | U.S. liquids production |  | U.S. natural gas production |  | U.S. liquids reserves |  | U.S. natural gas reserves |  | U.S. net wells drilled |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 270 | 0.034 | 212 | 0.595 | 255 | 0.292 | 202 | 9.634 | 265 | 0.034 | 208 | 0.595 | 249 | 0.292 | 195 | 9.634 | 171 | 0.970 |
| 352 | 0.005 | 281 | 0.165 | 181 | 1.050 | 219 | 6.578 | 352 | 0.004 | 346 | 0.046 | 176 | 1.033 | 229 | 5.269 | — | 0 |
| 240 | 0.048 | 211 | 0.601 | 286 | 0.191 | 273 | 2.500 | 234 | 0.048 | 207 | 0.601 | 283 | 0.191 | 271 | 2.500 | 180 | 0.740 |
| 187 | 0.099 | 192 | 0.974 | 234 | 0.438 | 229 | 5.598 | 182 | 0.099 | 188 | 0.974 | 227 | 0.438 | 223 | 5.598 | — | NA |
| 167 | 0.130 | 291 | 0.141 | 152 | 1.511 | 298 | 1.518 | 162 | 0.130 | 289 | 0.141 | 145 | 1.511 | 296 | 1.518 | — | 0 |
| 340 | 0.008 | 278 | 0.176 | 340 | 0.060 | 214 | 6.883 | 342 | 0.008 | 278 | 0.176 | 337 | 0.060 | 209 | 6.883 | 155 | 1.450 |
| 278 | 0.028 | 366 | 0.026 | 289 | 0.188 | 204 | 8.693 | 274 | 0.028 | 366 | 0.026 | 286 | 0.188 | 199 | 8.693 | 208 | 0.240 |
| 163 | 0.139 | 262 | 0.251 | 164 | 1.293 | 308 | 1.287 | 156 | 0.139 | 261 | 0.251 | 157 | 1.293 | 306 | 1.287 | 123 | 2.750 |
| 176 | 0.119 | 367 | 0.026 | 211 | 0.676 | 376 | 0.116 | 173 | 0.119 | 367 | 0.026 | 205 | 0.676 | 376 | 0.116 | 170 | 1.000 |
| 269 | 0.035 | 265 | 0.235 | 278 | 0.215 | 279 | 2.218 | 262 | 0.035 | 264 | 0.235 | 274 | 0.215 | 277 | 2.218 | — | NA |
| 262 | 0.037 | 175 | 1.346 | 270 | 0.246 | 203 | 8.915 | 256 | 0.037 | 172 | 1.346 | 266 | 0.246 | 198 | 8.915 | 106 | 4.103 |
| 266 | 0.035 | 290 | 0.141 | 235 | 0.436 | 226 | 6.146 | 261 | 0.035 | 290 | 0.141 | 228 | 0.436 | 220 | 6.146 | 210 | 0.220 |
| 314 | 0.018 | 269 | 0.214 | 327 | 0.090 | 312 | 0.950 | 305 | 0.018 | 268 | 0.214 | 323 | 0.090 | 311 | 0.950 | 176 | 0.816 |
| 229 | 0.057 | 267 | 0.223 | 263 | 0.266 | 302 | 1.436 | 223 | 0.057 | 266 | 0.223 | 257 | 0.266 | 300 | 1.436 | 112 | 3.553 |
| 298 | 0.021 | 196 | 0.919 | 280 | 0.208 | 236 | 5.089 | 296 | 0.021 | 191 | 0.919 | 277 | 0.208 | 231 | 5.089 | 229 | 0.007 |
| 178 | 0.117 | 320 | 0.092 | 170 | 1.146 | 316 | 0.826 | 175 | 0.117 | 319 | 0.0[illegible] | 164 | 1.146 | 316 | 0.826 | 181 | 0.700 |
| 356 | 0.004 | — | 0 | 239 | 0.386 | — | 0 | 361 | 0.004 | — | 0 | 232 | 0.386 | — | 0 | 168 | 1.000 |
| 282 | 0.027 | 261 | 0.253 | 331 | 0.083 | 249 | 3.722 | 277 | 0.027 | 260 | 0.253 | 327 | 0.083 | 246 | 3.722 | — | NA |
| 335 | 0.009 | 271 | 0.198 | 321 | 0.100 | 260 | 2.932 | 333 | 0.009 | 270 | 0.198 | 317 | 0.100 | 259 | 2.932 | — | 0 |
| 297 | 0.022 | 266 | 0.233 | 227 | 0.497 | 216 | 6.873 | 293 | 0.022 | 265 | 0.233 | 220 | 0.497 | 211 | 6.873 | 197 | 0.471 |
| 311 | 0.018 | 233 | 0.425 | 339 | 0.061 | 267 | 2.753 | 310 | 0.018 | 230 | 0.425 | 336 | 0.061 | 265 | 2.753 | — | NA |
| 182 | 0.107 | 217 | 0.557 | 252 | 0.312 | 304 | 1.388 | 178 | 0.107 | 213 | 0.557 | 244 | 0.312 | 303 | 1.388 | — | 0 |
| 370 | 0.003 | 311 | 0.102 | 364 | 0.023 | 358 | 0.367 | 366 | 0.003 | 310 | 0.102 | 364 | 0.023 | 356 | 0.367 | 173 | 0.880 |
| 255 | 0.039 | 247 | 0.331 | 253 | 0.306 | 251 | 3.713 | 249 | 0.039 | 245 | 0.331 | 246 | 0.306 | 248 | 3.713 | 127 | 2.549 |
| 306 | 0.019 | 225 | 0.496 | 311 | 0.126 | 238 | 4.820 | 301 | 0.019 | 221 | 0.496 | 306 | 0.126 | 233 | 4.820 | 128 | 2.520 |
| 295 | 0.022 | 195 | 0.934 | 303 | 0.137 | 233 | 5.381 | 291 | 0.022 | 190 | 0.934 | 300 | 0.137 | 227 | 5.381 | — | NA |
| 378 | 0.002 | 215 | 0.576 | 106 | 4.038 | 187 | 11.95 | 376 | 0.002 | 211 | 0.576 | 99 | 4.038 | 185 | 11.95 | 206 | 0.263 |
| — | 0 | 350 | 0.046 | — | 0 | 296 | 1.577 | — | 0 | 348 | 0.046 | — | 0 | 294 | 1.577 | — | 0 |
| 263 | 0.036 | 330 | 0.078 | 212 | 0.664 | 258 | 3.438 | 258 | 0.036 | 329 | 0.078 | 206 | 0.664 | 256 | 3.438 | — | 0 |
| 329 | 0.012 | 318 | 0.094 | 347 | 0.043 | 262 | 2.899 | 326 | 0.012 | 317 | 0.094 | 344 | 0.043 | 260 | 2.899 | — | 0 |
| — | 0 | 385 | 0.006 | 353 | 0.032 | 208 | 8.497 | — | 0 | 385 | 0.006 | 350 | 0.032 | 203 | 8.497 | — | NA |
| 213 | 0.076 | 210 | 0.614 | 241 | 0.375 | 253 | 3.638 | 207 | 0.076 | 205 | 0.614 | 234 | 0.375 | 250 | 3.638 | — | NA |
| 206 | 0.083 | 276 | 0.179 | 221 | 0.579 | 271 | 2.578 | 201 | 0.083 | 276 | 0.179 | 215 | 0.579 | 269 | 2.578 | 162 | 1.280 |
| 248 | 0.044 | 234 | 0.422 | 257 | 0.288 | 275 | 2.487 | 242 | 0.044 | 231 | 0.422 | 251 | 0.288 | 273 | 2.487 | — | NA |
| 230 | 0.056 | 252 | 0.306 | 244 | 0.366 | 305 | 1.383 | 225 | 0.056 | 249 | 0.306 | 237 | 0.366 | 303 | 1.383 | 221 | 0.109 |
| 212 | 0.076 | 301 | 0.125 | 271 | 0.245 | 294 | 1.673 | 208 | 0.076 | 300 | 0.125 | 267 | 0.245 | 292 | 1.673 | 119 | 3.000 |
| 322 | 0.014 | 255 | 0.283 | 313 | 0.124 | 222 | 6.478 | 320 | 0.014 | 253 | 0.283 | 309 | 0.124 | 216 | 6.478 | — | 0 |
| 300 | 0.021 | 257 | 0.265 | 287 | 0.189 | 277 | 2.354 | 294 | 0.021 | 256 | 0.265 | 284 | 0.189 | 275 | 2.354 | 166 | 1.100 |
| 342 | 0.008 | 272 | 0.189 | 356 | 0.029 | 328 | 0.606 | 341 | 0.008 | 271 | 0.189 | 353 | 0.029 | 328 | 0.606 | — | 0 |
| 227 | 0.060 | 326 | 0.082 | 238 | 0.406 | 324 | 0.685 | 222 | 0.060 | 325 | 0.082 | 231 | 0.406 | 324 | 0.685 | 190 | 0.520 |
| 321 | 0.014 | 342 | 0.062 | 361 | 0.026 | 269 | 2.687 | 319 | 0.014 | 339 | 0.062 | 358 | 0.026 | 267 | 2.687 | — | 0 |
| 293 | 0.023 | 277 | 0.178 | 306 | 0.135 | 303 | 1.426 | 290 | 0.023 | 277 | 0.178 | 303 | 0.135 | 301 | 1.426 | — | NA |
| 233 | 0.054 | 282 | 0.163 | 247 | 0.354 | 160 | 19.00 | 228 | 0.054 | 281 | 0.163 | 240 | 0.354 | 157 | 19.00 | 137 | 2.000 |
| 221 | 0.067 | 328 | 0.081 | 252 | 0.309 | 355 | 0.376 | 215 | 0.067 | 328 | 0.081 | 245 | 0.309 | 354 | 0.376 | — | NA |
| 225 | 0.061 | 310 | 0.103 | 319 | 0.104 | 327 | 0.648 | 221 | 0.061 | 309 | 0.103 | 315 | 0.104 | 327 | 0.648 | 135 | 2.000 |
| 305 | 0.019 | 232 | 0.425 | 307 | 0.135 | 257 | 3.472 | 302 | 0.019 | 229 | 0.425 | 304 | 0.135 | 255 | 3.472 | — | 0 |
| 264 | 0.036 | 285 | 0.152 | 269 | 0.254 | 340 | 0.449 | 260 | 0.036 | 284 | 0.152 | 262 | 0.254 | 340 | 0.449 | — | NA |
| 366 | 0.003 | 280 | 0.166 | 381 | 0.005 | 326 | 0.656 | 367 | 0.003 | 280 | 0.166 | 384 | 0.005 | 326 | 0.656 | — | 0 |
| 265 | 0.036 | 270 | 0.208 | 283 | 0.200 | 291 | 1.798 | 259 | 0.036 | 269 | 0.208 | 280 | 0.200 | 289 | 1.798 | — | NA |
| 347 | 0.007 | 323 | 0.084 | 341 | 0.058 | 314 | 0.862 | 345 | 0.007 | 322 | 0.084 | 338 | 0.058 | 314 | 0.862 | — | 0 |
| 284 | 0.026 | 268 | 0.223 | 165 | 1.229 | 217 | 6.862 | 312 | 0.017 | 267 | 0.223 | 161 | 1.187 | 212 | 6.860 | 191 | 0.500 |

| Rank by total — assets — 1989 | 1988 | Company | Total assets $000 | — Total revenue — Rank | $000 | — Net income — Rank | $000 | —— Stockholders' equity —— Rank | $000 | — Capital & Expl. spending — Rank | $000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 307 | 318 | Chaparral Resources Inc.[67] | 2,711 | 307 | 807 | 194 | 91 | 286 | 1,858 | 279 | 231 |
| 308 | — | Foreland Corp. | 2,688 | 337 | 543 | 335 | (800) | 353 | 572 | 372 | 15 |
| 309 | 315 | Tatum Petroleum Corp.[44] | 2,650 | 345 | 471 | 322 | (577) | 270 | 2,337 | 314 | 87 |
| 310 | — | Enex Oil & Gas Income Prog. IV-Series 1, L.P. | 2,607 | 320 | 678 | 210 | 30 | 269 | [11]2,519 | 356 | 27 |
| 311 | — | Enex Oil & Gas Income Prog. III-Series 6, L.P. | 2,565 | 300 | 912 | 182 | 136 | 271 | [11]2,315 | 289 | 191 |
| 312 | 347 | Plano Petroleum Corp.[10] | 2,486 | 314 | 731 | 313 | (459) | 275 | 2,269 | 299 | 121 |
| 313 | — | Enex Oil & Gas Income Program II-3 | 2,378 | 370 | 259 | 261 | (105) | 276 | [11]2,188 | 375 | 10 |
| 314 | 316 | Monogram Oil & Gas Inc.[85] | 2,346 | 304 | 894 | 303 | (321) | 386 | (5,661) | 339 | 40 |
| 315 | 321 | Crescent Oil & Gas Corp.[10] | 2,345 | 362 | 318 | 240 | (20) | 278 | 2,117 | 318 | 76 |
| 316 | 320 | NY Life Oil & Gas Producing Properties I-B,Ltd. | 2,343 | 273 | 1,483 | 162 | 352 | 274 | [11]2,271 | 300 | 120 |
| 317 | 345 | Intramerican Oil & Minerals Inc. | 2,325 | 284 | 1,194 | 200 | 71 | 300 | 1,609 | 288 | 199 |
| 318 | — | Enex Oil & Gas Income Program II-7 | 2,294 | 329 | 599 | 244 | (30) | 283 | [11]1,894 | 342 | 38 |
| 319 | 353 | The Exploration Co.[23] | 2,116 | 360 | 329 | 272 | (145) | 348 | 611 | — | 0 |
| 320 | 378 | Republic Waste Industries, Inc.[83] | 2,113 | 319 | 678 | 101 | 1,918 | 280 | 2,008 | 377 | 8 |
| 321 | 299 | Altex Industries, Inc.[10] | 2,100 | 326 | 619 | 361 | (2,112) | 292 | 1,815 | 315 | 83 |
| 322 | 331 | Coastal Strategies Income Fund B | 2,065 | 386 | 168 | 236 | (16) | 279 | [11]2,012 | 221 | 671 |
| 323 | — | Bogert 1986 - IV L.P. | 2,018 | 303 | 894 | 256 | (80) | 296 | [11]1,729 | — | 0 |
| 324 | — | Enex Oil & Gas Income Program II-4 | 2,010 | 373 | 243 | 260 | (101) | 293 | [11]1,776 | 374 | 10 |
| 325 | — | Enex Oil & Gas Income Prog. IV-Series 2, L.P. | 2,008 | 340 | 530 | 234 | (11) | 282 | [11]1,945 | 358 | 26 |
| 326 | 354 | Ratex Resources Inc. | 2,000 | 287 | 1,107 | 275 | (149) | 321 | 1,190 | 309 | 100 |
| 327 | 330 | Sheffield Exploration Co. Inc.[29] | 1,994 | 296 | 933 | 295 | (271) | 294 | 1,759 | 256 | 363 |
| 328 | — | Enex Oil & Gas Income Program II-5 | 1,911 | 327 | 617 | 233 | (10) | 307 | [11]1,490 | 351 | 29 |
| 329 | 338 | Coastal Strategies Income Fund A | 1,893 | 369 | 261 | 230 | (7) | 285 | [11]1,876 | 215 | 720 |
| 330 | 328 | Paine Webber/Geodyne Energy Income L.P. I-A | 1,852 | 335 | 555 | 251 | (45) | 287 | [11]1,852 | 371 | 16 |
| 331 | — | Enex Oil & Gas Income Prog. III-Series 7, L.P. | 1,849 | 324 | 648 | 193 | 94 | 298 | [11]1,677 | 297 | 137 |
| 332 | 342 | Petrol Industries, Inc. | 1,840 | 276 | 1,407 | 208 | 32 | 297 | 1,717 | 308 | 101 |
| 333 | 333 | Appalachian Oil & Gas Co., Inc.[29] | 1,827 | 297 | 936 | 209 | 31 | 363 | 301 | 257 | 360 |
| 334 | — | Mountain States Resources Corp.[44] | 1,823 | 306 | 815 | 323 | (585) | 365 | 283 | 272 | 258 |
| 335 | — | Enex Oil & Gas Income Program II-6 | 1,801 | 333 | 574 | 214 | 22 | 313 | [11]1,356 | 357 | 27 |
| 336 | — | Search Natural Resources, Inc. | 1,792 | 316 | 724 | 177 | 157 | 367 | 263 | 268 | 278 |
| 337 | — | Enex Oil & Gas Income Prog. III-Series 3, L.P. | 1,767 | 341 | 514 | 245 | (31) | 309 | [11]1,422 | 345 | 33 |
| 338 | 352 | Sharon Energy Ltd.[44] | 1,739 | 311 | 757 | 257 | (86) | 376 | (76) | 237 | 513 |
| 339 | 341 | Double Eagle Petroleum and Mining Co.[23] | 1,727 | 318 | 703 | 270 | (140) | 299 | 1,627 | 242 | 449 |
| 340 | — | Enex Oil & Gas Income Program II-8 | 1,683 | 349 | 431 | 232 | (9) | 316 | [11]1,277 | 353 | 28 |
| 341 | 344 | Golden Triangle Royalty & Oil, Inc. | 1,669 | 389 | 144 | 304 | (330) | 303 | 1,542 | 348 | 31 |
| 342 | — | Enex 88-89 Income & Retire. Fund-Series 4, L.P. | 1,625 | 388 | 163 | 247 | (36) | 302 | [11]1,544 | 202 | 976 |
| 343 | 337 | Penn-Pacific Corp.[10] | 1,622 | 383 | 193 | 359 | (2,065) | 320 | 1,22[illegible] | 362 | 23 |
| 344 | 346 | Nova Natural Resources Corp.[10] | 1,589 | 310 | 763 | 280 | (196) | 305 | 1,504 | 287 | 200 |
| 345 | 355 | Willard Pease Oil & Gas Co. | 1,543 | 342 | 492 | 259 | (93) | 361 | 398 | 313 | 87 |
| 346 | 335 | Imperial Petroleum Inc.[86,84] | 1,526 | 394 | 80 | 316 | (517) | 322 | 1,186 | 325 | 56 |
| 347 | — | Enex 88-89 Income & Retire. Fund-Series 3, L.P. | 1,521 | 377 | 208 | 206 | 38 | 310 | [11]1,405 | 196 | 1,075 |
| 348 | 326 | Prudential-Bache Pension & Retirement L.P. PBR-1 | 1,504 | 356 | 365 | 325 | (592) | 306 | [11]1,503 | — | 0 |
| 349 | 350 | Big Piney Oil & Gas Co. | 1,483 | 372 | 243 | 267 | (121) | 311 | 1,398 | 319 | 73 |
| 350 | — | Gladstone Resources Inc.[85] | 1,475 | 385 | 172 | 235 | (12) | 315 | 1,287 | — | 0 |
| 351 | — | Enex Oil & Gas Income Prog. III-Series 4, L.P. | 1,473 | 315 | 730 | 242 | (27) | 317 | [11]1,253 | 320 | 72 |
| 352 | — | Hughes Texas Petroleum Corp. | 1,465 | 368 | 264 | 288 | (236) | 372 | 122 | 262 | 311 |
| 353 | 322 | Senergy 1986 Ltd. | 1,450 | 323 | 651 | 332 | (750) | 334 | [11]915 | 317 | 79 |
| 354 | 334 | Pantepec International, Inc. | 1,409 | 366 | 293 | 310 | (412) | 312 | 1,378 | 306 | 105 |
| 355 | — | Enex 88-89 Income & Retire. Fund-Series 1, L.P. | 1,391 | 364 | 316 | 226 | (3) | 314 | [11]1,290 | 205 | 928 |
| 356 | — | Enex Oil & Gas Income Prog. III-Series 2, L.P. | 1,379 | 330 | 585 | 213 | 24 | 332 | [11]939 | 321 | 68 |
| 357 | — | Enex 88-89 Income & Retire. Fund-Series 2, L.P. | 1,377 | 379 | 199 | 211 | 30 | 318 | [11]1,244 | 192 | 1,115 |

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 280 | 0.028 | 288 | 0.143 | 266 | 0.259 | 304 | 1.408 | 276 | 0.028 | 286 | 0.143 | 260 | 0.259 | 302 | 1.408 | 185 | 0.550 |
| 299 | 0.021 | — | 0 | 219 | 0.589 | — | 0 | 297 | 0.021 | — | 0 | 213 | 0.589 | — | 0 | — | 0 |
| 326 | 0.013 | 321 | 0.088 | 246 | 0.362 | 248 | 3.766 | 322 | 0.013 | 320 | 0.088 | 239 | 0.362 | 245 | 3.766 | 136 | 2.000 |
| 312 | 0.018 | 283 | 0.160 | 296 | 0.155 | 337 | 0.480 | 309 | 0.018 | 282 | 0.160 | 293 | 0.155 | 337 | 0.480 | — | 0 |
| 256 | 0.039 | 287 | 0.143 | 262 | 0.268 | 335 | 0.546 | 250 | 0.039 | 287 | 0.143 | 256 | 0.268 | 335 | 0.546 | — | NA |
| 307 | 0.018 | 322 | 0.087 | 320 | 0.103 | 310 | 1.035 | 307 | 0.018 | 321 | 0.087 | 316 | 0.103 | 309 | 1.035 | 201 | 0.360 |
| 363 | 0.004 | 309 | 0.107 | 375 | 0.013 | 288 | 1.884 | 360 | 0.004 | 307 | 0.107 | 373 | 0.013 | 286 | 1.884 | — | 0 |
| 332 | 0.010 | 251 | 0.306 | 358 | 0.029 | 292 | 1.790 | 330 | 0.010 | 250 | 0.306 | 355 | 0.029 | 290 | 1.790 | — | 0 |
| 360 | 0.004 | 279 | 0.168 | 350 | 0.034 | 235 | 5.103 | 359 | 0.004 | 279 | 0.168 | 347 | 0.034 | 230 | 5.103 | 158 | 1.370 |
| 249 | 0.043 | 230 | 0.430 | 282 | 0.201 | 272 | 2.542 | 243 | 0.043 | 227 | 0.430 | 279 | 0.201 | 270 | 2.542 | — | NA |
| 372 | 0.002 | 312 | 0.099 | 300 | 0.145 | 323 | 0.701 | 370 | 0.002 | 311 | 0.099 | 297 | 0.145 | 323 | 0.701 | 228 | 0.033 |
| 283 | 0.026 | 313 | 0.098 | 290 | 0.186 | 360 | 0.331 | 279 | 0.026 | 312 | 0.098 | 287 | 0.186 | 359 | 0.331 | — | NA |
| 373 | 0.002 | 379 | 0.013 | 387 | 0.003 | 388 | 0.058 | 378 | 0.002 | 379 | 0.013 | 386 | 0.003 | 388 | 0.058 | — | 0 |
| 369 | 0.003 | 365 | 0.030 | 378 | 0.009 | 386 | 0.064 | 363 | 0.003 | 364 | 0.030 | 377 | 0.009 | 386 | 0.064 | — | 0 |
| 287 | 0.025 | 369 | 0.022 | 305 | 0.135 | 378 | 0.098 | 281 | 0.025 | 369 | 0.022 | 302 | 0.135 | 378 | 0.098 | 222 | 0.100 |
| 367 | (s) | 359 | 0.035 | 390 | 0.001 | 283 | 2.100 | 367 | (s) | 358 | 0.035 | 389 | 0.001 | 281 | 2.100 | — | 0 |
| 313 | 0.018 | 246 | 0.345 | 323 | 0.097 | 282 | 2.111 | 308 | 0.018 | 244 | 0.345 | 319 | 0.097 | 280 | 2.111 | — | 0 |
| 353 | 0.005 | 316 | 0.096 | 374 | 0.013 | 297 | 1.575 | 348 | 0.005 | 315 | 0.096 | 374 | 0.013 | 295 | 1.575 | — | 0 |
| 318 | 0.015 | 305 | 0.117 | 317 | 0.114 | 362 | 0.307 | 317 | 0.015 | 304 | 0.117 | 313 | 0.114 | 361 | 0.307 | — | 0 |
| 286 | 0.025 | 241 | 0.370 | 326 | 0.094 | 293 | 1.687 | 282 | 0.025 | 239 | 0.370 | 322 | 0.094 | 291 | 1.687 | 188 | 0.532 |
| 261 | 0.038 | 324 | 0.083 | 275 | 0.228 | 351 | 0.403 | 255 | 0.038 | 324 | 0.083 | 271 | 0.228 | 350 | 0.403 | — | 0 |
| 289 | 0.024 | 299 | 0.127 | 308 | 0.133 | 352 | 0.397 | 284 | 0.024 | 298 | 0.127 | 305 | 0.133 | 351 | 0.397 | — | NA |
| 377 | 0.002 | 296 | 0.133 | 385 | 0.005 | 259 | 3.270 | 380 | 0.002 | 295 | 0.133 | 380 | 0.005 | 257 | 3.270 | — | 0 |
| 341 | 0.008 | 263 | 0.249 | 359 | 0.027 | 299 | 1.492 | 337 | 0.008 | 262 | 0.249 | 356 | 0.027 | 297 | 1.492 | — | NA |
| 276 | 0.029 | 319 | 0.093 | 288 | 0.189 | 356 | 0.369 | 272 | 0.029 | 318 | 0.093 | 285 | 0.189 | 355 | 0.369 | — | NA |
| 218 | 0.073 | — | 0 | 86 | 5.887 | — | 0 | 213 | 0.073 | — | 0 | 78 | 5.887 | — | 0 | 138 | 2.000 |
| 391 | (s) | 249 | 0.330 | — | 0 | 285 | 2.042 | 391 | (s) | 246 | 0.330 | — | 0 | 283 | 2.042 | — | NA |
| 375 | 0.002 | 386 | 0.004 | 388 | 0.002 | 393 | 0.007 | 379 | 0.002 | 386 | 0.004 | 388 | 0.002 | 393 | 0.007 | — | NA |
| 290 | 0.024 | 315 | 0.096 | 304 | 0.136 | 363 | 0.299 | 286 | 0.024 | 316 | 0.096 | 301 | 0.136 | 362 | 0.299 | — | NA |
| 348 | 0.006 | 295 | 0.135 | 383 | 0.005 | 366 | 0.281 | 346 | 0.006 | 294 | 0.135 | 379 | 0.005 | 366 | 0.281 | — | NA |
| 285 | 0.026 | 368 | 0.026 | 291 | 0.175 | 375 | 0.118 | 280 | 0.026 | 368 | 0.026 | 288 | 0.175 | 375 | 0.118 | — | NA |
| 251 | 0.042 | 358 | 0.037 | 276 | 0.218 | 346 | 0.426 | 244 | 0.042 | 356 | 0.037 | 272 | 0.218 | 344 | 0.426 | 117 | 3.250 |
| 267 | 0.035 | 340 | 0.062 | 293 | 0.169 | 317 | 0.796 | 264 | 0.035 | 340 | 0.062 | 290 | 0.169 | 317 | 0.796 | — | 0 |
| 303 | 0.020 | 343 | 0.059 | 299 | 0.151 | 371 | 0.211 | 300 | 0.020 | 341 | 0.059 | 295 | 0.151 | 371 | 0.211 | — | NA |
| 383 | 0.001 | 388 | 0.003 | 379 | 0.006 | 390 | 0.040 | 384 | 0.001 | 388 | 0.003 | 378 | 0.006 | 391 | 0.040 | — | 0 |
| 374 | 0.002 | 357 | 0.037 | 372 | 0.015 | 354 | 0.384 | 375 | 0.002 | 357 | 0.037 | 371 | 0.015 | 352 | 0.384 | — | NA |
| 365 | 0.003 | 333 | 0.076 | 366 | 0.020 | 329 | 0.578 | 365 | 0.003 | 331 | 0.076 | 365 | 0.020 | 329 | 0.578 | — | 0 |
| 323 | 0.014 | 317 | 0.096 | 325 | 0.095 | 357 | 0.367 | 321 | 0.014 | 314 | 0.096 | 321 | 0.095 | 357 | 0.367 | — | 0 |
| 320 | 0.015 | 349 | 0.046 | 176 | 1.085 | 255 | 3.584 | 315 | 0.015 | 347 | 0.046 | 170 | 1.085 | 253 | 3.584 | — | 0 |
| 361 | 0.004 | 389 | 0.001 | 315 | 0.118 | 377 | 0.104 | 356 | 0.004 | 389 | 0.001 | 311 | 0.118 | 377 | 0.104 | — | 0 |
| 376 | 0.002 | 355 | 0.040 | 367 | 0.019 | 348 | 0.421 | 371 | 0.002 | 355 | 0.040 | 367 | 0.019 | 347 | 0.421 | — | NA |
| 279 | 0.028 | 293 | 0.137 | 258 | 0.282 | 345 | 0.426 | 275 | 0.028 | 292 | 0.137 | 252 | 0.282 | 345 | 0.426 | — | 0 |
| — | 0 | 307 | 0.110 | — | 0 | 265 | 2.802 | — | 0 | 305 | 0.110 | — | 0 | 263 | 2.802 | — | NA |
| — | 0 | 334 | $^{85}$0.075 | — | 0 | 268 | $^{85}$2.707 | — | 0 | 333 | 0.075 | — | 0 | 266 | $^{85}$2.707 | — | NA |
| 275 | 0.029 | 345 | 0.054 | 329 | 0.088 | 336 | 0.533 | 271 | 0.029 | 343 | 0.054 | 325 | 0.088 | 336 | 0.533 | — | 0 |
| 336 | 0.009 | 314 | 0.097 | 251 | 0.317 | 344 | 0.428 | 332 | 0.009 | 313 | 0.097 | 244 | 0.317 | 343 | 0.428 | — | 0 |
| 292 | 0.023 | 286 | 0.151 | 344 | 0.051 | 334 | 0.548 | 289 | 0.023 | 285 | 0.151 | 341 | 0.051 | 334 | 0.548 | — | NA |
| 362 | 0.004 | 304 | 0.117 | 360 | 0.026 | 320 | 0.743 | 353 | 0.004 | 303 | 0.117 | 359 | 0.026 | 320 | 0.743 | 207 | 0.250 |
| 367 | 0.003 | 335 | 0.070 | 362 | 0.025 | 331 | 0.566 | 364 | 0.003 | 334 | 0.070 | 361 | 0.025 | 331 | 0.566 | — | NA |
| 257 | 0.038 | 372 | 0.018 | 294 | 0.167 | 382 | 0.077 | 253 | 0.038 | 373 | 0.018 | 291 | 0.167 | 382 | 0.077 | — | NA |
| 379 | 0.002 | 354 | 0.042 | 368 | 0.019 | 341 | 0.445 | 381 | 0.002 | 351 | 0.042 | 366 | 0.019 | 341 | 0.445 | — | NA |

# OGJ400

| Rank by total assets 1989 | Rank by total assets 1988 | Company | Total assets $000 | Total revenue Rank | Total revenue $000 | Net income Rank | Net income $000 | Stockholders' equity Rank | Stockholders' equity $000 | Capital & Expl. spending Rank | Capital & Expl. spending $000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 358 | 359 | Reserve Exploration Co.[44] | 1,324 | 350 | 418 | 258 | (91) | 346 | 631 | 285 | 204 |
| 359 | 363 | Tri-Valley Corp.[66] | 1,292 | 387 | 166 | 299 | (308) | 349 | 602 | 296 | 143 |
| 360 | 323 | Aspen Exploration Corp.[29] | 1,290 | 317 | 714 | 353 | (1,590) | 323 | 1,140 | 283 | 210 |
| 361 | 349 | Roberts Oil and Gas Inc.[19] | 1,283 | 332 | 578 | 283 | (200) | 379 | (332) | 302 | 119 |
| 362 | 369 | Texas Vanguard Oil Co. | 1,266 | 308 | 802 | 186 | 115 | 337 | 840 | 253 | 383 |
| 363 | — | Enex Oil & Gas Income Program II-10 | 1,264 | 365 | 301 | 229 | (6) | 338 | [11]818 | 365 | 22 |
| 364 | 358 | Halley Energy Corp. | 1,259 | 344 | 473 | 255 | (68) | 333 | 938 | 376 | 8 |
| 365 | 367 | Coastal Strategies Income Fund C | 1,255 | 397 | 70 | 252 | (52) | 319 | [11]1,238 | 247 | 403 |
| 366 | 386 | TPEX Exploration Inc.[29] | 1,228 | 338 | 541 | 265 | (117) | 358 | 468 | 224 | 627 |
| 367 | 361 | DOL Resources, Inc. | 1,208 | 392 | 106 | 221 | 3 | 351 | 600 | — | 0 |
| 368 | 340 | Taurus Petroleum Inc.[10] | 1,190 | 336 | 553 | 307 | (368) | 341 | 730 | 352 | 28 |
| 369 | — | Enex Oil & Gas Income Prog. IV-Series 4, L.P. | 1,156 | 395 | 78 | 254 | (59) | 325 | [11]1,066 | 380 | 3 |
| 370 | 366 | Struthers Oil & Gas Corp.[86] | 1,153 | 321 | 669 | 268 | (132) | 370 | 206 | 312 | 90 |
| 371 | — | Enex Income and Retirement Fund-Series 3, L.P. | 1,089 | 359 | 346 | 237 | (17) | 330 | [11]975 | 226 | 592 |
| 372 | 356 | Western Energy Resources Inc. | 1,072 | 380 | 196 | 292 | (262) | 328 | 1,020 | — | 0 |
| 373 | 327 | Broken Arrow Petroleum Co.[19] | 1,021 | 400 | 34 | 319 | (571) | 347 | 624 | 307 | 103 |
| 374 | — | Enex Income and Retirement Fund-Series 2, L.P. | 1,005 | 361 | 322 | 212 | 26 | 331 | [11]953 | 301 | 119 |
| 375 | — | Enex Oil & Gas Income Program II-9 | 996 | 374 | 239 | 231 | (9) | 352 | [11]578 | 368 | 17 |
| 376 | 370 | Minex Resources Inc.[87] | 971 | 396 | 72 | 249 | (40) | 335 | 874 | 344 | 35 |
| 377 | — | Enex Oil & Gas Income Prog. III-Series 1, L.P. | 959 | 353 | 408 | 223 | 1 | 356 | [11]515 | 333 | 47 |
| 378 | 379 | Bolyard Oil & Gas Ltd.[75,87] | 947 | 371 | 245 | 269 | (138) | 360 | 442 | 236 | 513 |
| 379 | 374 | Eagle Exploration Co.[44] | 923 | 305 | 818 | 185 | 116 | 339 | 813 | 280 | 224 |
| 380 | 380 | Standard Oil & Exploration of Delaware Inc. | 914 | 296 | 943 | 192 | 98 | 336 | 842 | 276 | 244 |
| 381 | 364 | South Texas Drilling & Exploration, Inc.[44] | 913 | 247 | 2,136 | 282 | (199) | 355 | 568 | 322 | 62 |
| 382 | 351 | General Energy Resources & Technology Corp. | 867 | 334 | 571 | 314 | (460) | 373 | 69 | 270 | 267 |
| 383 | — | Enex Income and Retirement Fund-Series 1, L.P. | 866 | 381 | 195 | 217 | 9 | 343 | [11]688 | — | 0 |
| 384 | 381 | Amacan Resources Corp. | 861 | 382 | 195 | 246 | (31) | 340 | 746 | 304 | 113 |
| 385 | 377 | Wyoming Oil & Minerals, Inc.[58] | 833 | 378 | 206 | 215 | 22 | 357 | 503 | 378 | 3 |
| 386 | 371 | Stellar Petroleum Inc.[10] | 827 | 399 | 35 | 273 | (147) | 342 | 691 | 379 | 3 |
| 387 | 365 | Morrison Nuclear Inc.[88] | 817 | 312 | 747 | 301 | (313) | 384 | (2,936) | — | 0 |
| 388 | 384 | Oil City Petroleum Inc.[23] | 737 | 393 | 96 | 274 | (149) | 362 | 356 | 381 | 1 |
| 389 | 360 | Lynx Exploration Co.[10] | 721 | 351 | 418 | 311 | (450) | 364 | 296 | 335 | 45 |
| 390 | 389 | Yellowstone Resources, Inc. | 708 | 391 | 122 | 271 | (142) | 344 | 646 | 298 | 122 |
| 391 | — | National Petroleum Corp. Limited[61,67] | 685 | 375 | 223 | 228 | (5) | 375 | 27 | 373 | 11 |
| 392 | 388 | Great Northern Gas Co.[89] | 681 | 363 | 316 | 216 | 12 | 354 | 568 | 336 | 42 |
| 393 | 312 | International Management & Research Corp.[90] | 670 | 346 | 465 | 339 | (953) | 378 | (282) | 382 | 1 |
| 394 | 392 | Triumph Oil & Gas Corp.[29] | 627 | 309 | 789 | 290 | (253) | 377 | (112) | — | 0 |
| 395 | — | Senergy 1985 Ltd. | 609 | 376 | 214 | 243 | (28) | 368 | [11]260 | 332 | 48 |
| 396 | 390 | Mexco Energy Corp.[44] | 606 | 367 | 293 | 207 | 34 | 350 | 600 | 323 | 62 |
| 397 | — | Carmel Energy Inc. | 587 | 322 | 667 | 204 | 48 | 371 | 130 | — | 0 |
| 398 | 387 | Sooner Energy Corp. | 563 | 348 | 431 | 276 | (153) | 366 | 272 | 324 | 60 |
| 399 | 393 | Hipoint Investments, Ltd. | 539 | 354 | 391 | 338 | (858) | 392 | (21,579) | 354 | 28 |
| 400 | — | North Star Petroleum Inc.[10] | 455 | 398 | 52 | 241 | (25) | 359 | 455 | 367 | 18 |
|  |  | **Totals** | 469,797,531 |  | 459,181,827 |  | 20,340,312 |  | 162,018,858 |  | 49,180,133 |

NA = Not Available. (s) indicates less than 500 bbl or 500 mcf. Fiscal yearend is Dec. 31 unless otherwise noted. 1. One of Royal Dutch/Shell group of companies, owned 60% by Royal Dutch Petroleum, The Netherlands, and 40% by The "Shell" Transport and Trading Co., plc, England. 2. Subsidiary of British Petroleum Co. plc. 3. Net income (loss) before interest and income taxes. 4. Marathon Oil Co. and Texas Oil & Gas are wholly-owned subsidiaries of USX, and they comprise the energy segment. 5. Subsidiary of E.I. du Pont de Nemours & Co. 6. After-tax operating income. 7. May contain insignificant amounts outside the U.S. 8. Includes natural gas systems. 9. Includes cost-of-service and non-cost of service. 10. Fiscal yearend Sept. 30. 11. Partners' capital. 12. Affiliated with and majority owned by Petrofina, S.A., Belgium. 13. Fiscal yearend Jan. 31, 1990. 14. Includes storage. 15. Subsidiary of Union Pacific Corp. 16. Unocal Corp., through its affiliates, owns 95.1%. 17. Freeport McMoRan Inc. and affiliates own 79.6%. 18. Subsidiary of Pacific Enterprises. 19. Fiscal yearend May 31. 20. Subsidiary of Broken Hill Proprietary. 21. 2 subsidiaries use the full cost accounting method and 1 uses the successful efforts. 22. ENSERCH Corp. owns 99.2%. 23. Fiscal yearend Aug. 31. 24. Santa Fe Pacific Corp. owns 81.7%. 25. Company completed public offering during 3rd quarter 1989. W.R. Grace & Co. owns 83.4%. 26. Under bankruptcy reorganization plan. 27. Subsidiary of NERCO, Inc. 28. Operating income. 29. Fiscal yearend June 30. 30. Members equity. 31. Formerly NRM Energy Co. LP. 32. Name has been changed to Hondo Oil & Gas Co. effective Jan. 1990. 33. Subsidiary of CMS Enterprises Co. 34. Subsidiary of Amax, Inc. 35. Maxus Energy Corp. owns 85.8%. 36. Filed voluntary bankruptcy petition in February 1990. 37. Snyder Oil owns 10%. Since fiscal year end, partnership and general partner have merged into Snyder Oil Corp. 38. Subsidiary of Bridge Oil Limited. 39. Subsidiary of Corona, which owns 62%. 40. Trust corpus. 41. Subsidiary of Brooklyn Union Gas Co. 42. Subsidiary of Chicago Bridge and Iron. 43. Formerly Saxon Oil Co. 44. Fiscal yearend March 31. 45. Formerly Saxon Oil Development Partners LP. Hallwood Energy Corp. owns 67%. 46. Subsidiary of Washington Energy Co. 47. 1989

| Worldwide liquids production | | Worldwide natural gas production | | Worldwide liquids reserves | | Worldwide natural gas reserves | | U.S. liquids production | | U.S. natural gas production | | U.S. liquids reserves | | U.S. natural gas reserves | | U.S. net wells drilled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Mill bbl | Rank | Bcf | Rank | Wells |
| 296 | 0.022 | 353 | 0.042 | 268 | 0.254 | 379 | 0.091 | 292 | 0.022 | 352 | 0.042 | 263 | 0.254 | 379 | 0.091 | 156 | 1.410 |
| — | 0 | 364 | 0.032 | — | 0 | 383 | 0.077 | — | 0 | 363 | 0.032 | — | 0 | 383 | 0.077 | 134 | 2.000 |
| 302 | 0.020 | 374 | 0.016 | 310 | 0.126 | 359 | 0.357 | 299 | 0.020 | 376 | 0.016 | 307 | 0.126 | 358 | 0.357 | 223 | 0.090 |
| 346 | 0.007 | 256 | 0.272 | 357 | 0.029 | 318 | 0.769 | 343 | 0.007 | 255 | 0.272 | 354 | 0.029 | 318 | 0.769 | 226 | 0.059 |
| 277 | 0.029 | 332 | 0.076 | 209 | 0.690 | 295 | 1.666 | 273 | 0.029 | 332 | 0.076 | 203 | 0.690 | 293 | 1.666 | 65 | 15.18 |
| 317 | 0.016 | 371 | 0.020 | 312 | 0.125 | 380 | 0.089 | 314 | 0.016 | 371 | 0.020 | 308 | 0.125 | 380 | 0.089 | — | NA |
| — | 0 | 384 | 0.006 | 377 | 0.009 | 332 | 0.565 | — | 0 | 384 | 0.006 | 378 | 0.009 | 332 | 0.565 | — | NA |
| 390 | (s) | 377 | 0.015 | 392 | (s) | 307 | 1.327 | 390 | (s) | 377 | 0.015 | 391 | (s) | 305 | 1.327 | — | 0 |
| 315 | 0.018 | 346 | 0.052 | 256 | 0.290 | 368 | 0.261 | 306 | 0.018 | 344 | 0.052 | 250 | 0.290 | 368 | 0.261 | — | 0 |
| 368 | 0.003 | 373 | 0.018 | 348 | 0.036 | 372 | 0.199 | 369 | 0.003 | 372 | 0.018 | 345 | 0.036 | 372 | 0.199 | — | 0 |
| 324 | 0.014 | 289 | 0.142 | 337 | 0.064 | 311 | 0.997 | 318 | 0.014 | 288 | 0.142 | 334 | 0.064 | 310 | 0.997 | — | 0 |
| 386 | (s) | 370 | 0.021 | 382 | 0.005 | 369 | 0.229 | 386 | (s) | 370 | 0.021 | 383 | 0.005 | 369 | 0.229 | — | 0 |
| 384 | 0.001 | 331 | 0.077 | 384 | 0.005 | 347 | 0.425 | 385 | 0.001 | 330 | 0.077 | 382 | 0.005 | 346 | 0.425 | — | 0 |
| 371 | 0.003 | 298 | 0.128 | 371 | 0.016 | 338 | 0.478 | 368 | 0.003 | 297 | 0.128 | 370 | 0.016 | 338 | 0.478 | — | NA |
| 350 | 0.005 | 337 | 0.068 | 314 | 0.121 | 309 | 1.062 | 350 | 0.005 | 336 | 0.068 | 310 | 0.121 | 308 | 1.062 | — | 0 |
| — | 0 | 387 | 0.003 | — | 0 | 237 | 4.823 | — | 0 | 387 | 0.003 | — | 0 | 232 | 4.823 | — | 0 |
| 354 | 0.004 | 297 | 0.132 | 369 | 0.017 | 322 | 0.722 | 355 | 0.004 | 296 | 0.132 | 368 | 0.017 | 322 | 0.722 | — | NA |
| 325 | 0.013 | 376 | 0.016 | 322 | 0.099 | 385 | 0.071 | 324 | 0.013 | 375 | 0.016 | 318 | 0.099 | 384 | 0.071 | — | NA |
| 381 | 0.002 | 391 | 0.001 | 335 | 0.067 | 381 | 0.089 | 372 | 0.002 | 391 | 0.001 | 332 | 0.067 | 381 | 0.089 | — | 0 |
| 281 | 0.027 | 380 | 0.012 | 316 | 0.116 | 389 | 0.054 | 278 | 0.027 | 380 | 0.012 | 312 | 0.116 | 389 | 0.054 | — | NA |
| 382 | 0.001 | 339 | 0.067 | 389 | 0.002 | 306 | 1.335 | 382 | 0.001 | 337 | 0.067 | 387 | 0.002 | 304 | 1.335 | — | 0 |
| 294 | 0.023 | 260 | 0.254 | 355 | 0.031 | 353 | 0.384 | 287 | 0.023 | 259 | 0.254 | 352 | 0.031 | 353 | 0.384 | 114 | 3.407 |
| 380 | 0.002 | 347 | 0.052 | 373 | 0.014 | 250 | 3.722 | 377 | 0.002 | 345 | 0.052 | 372 | 0.014 | 247 | 3.722 | 121 | 3.000 |
| 354 | 0.004 | 390 | 0.001 | 376 | 0.011 | 392 | 0.020 | 362 | 0.004 | 390 | 0.001 | 375 | 0.011 | 392 | 0.020 | 215 | 0.150 |
| 327 | 0.013 | 325 | 0.083 | 324 | 0.096 | 301 | 1.461 | 323 | 0.013 | 323 | 0.083 | 320 | 0.096 | 299 | 1.461 | — | 0 |
| 344 | 0.008 | 336 | 0.069 | 363 | 0.024 | 339 | 0.476 | 340 | 0.008 | 335 | 0.069 | 362 | 0.024 | 339 | 0.476 | — | NA |
| 343 | 0.008 | 360 | 0.035 | 336 | 0.067 | 365 | 0.286 | 338 | 0.008 | 359 | 0.035 | 333 | 0.067 | 365 | 0.286 | — | 0 |
| 345 | 0.008 | 375 | 0.016 | 332 | 0.081 | 319 | 0.745 | 339 | 0.008 | 374 | 0.016 | 328 | 0.081 | 319 | 0.745 | — | 0 |
| 388 | (s) | 383 | 0.007 | 334 | 0.072 | 321 | 0.737 | 388 | (s) | 383 | 0.007 | 331 | 0.072 | 321 | 0.737 | — | 0 |
| 254 | 0.040 | — | 0 | 318 | 0.108 | — | 0 | 248 | 0.040 | — | 0 | 314 | 0.108 | — | 0 | — | 0 |
| 351 | 0.005 | 392 | (s) | 330 | 0.084 | 391 | 0.040 | 349 | 0.005 | 392 | (s) | 326 | 0.084 | 390 | 0.040 | — | 0 |
| 333 | 0.010 | 363 | 0.033 | 236 | 0.434 | 364 | 0.288 | 329 | 0.010 | 362 | 0.033 | 229 | 0.434 | 363 | 0.288 | 205 | 0.310 |
| 349 | 0.005 | 382 | 0.011 | 349 | 0.035 | 384 | 0.071 | 347 | 0.005 | 382 | 0.011 | 346 | 0.035 | 385 | 0.071 | 198 | 0.450 |
| 337 | 0.009 | 348 | 0.047 | 309 | 0.130 | 343 | 0.435 | 373 | 0.002 | 365 | 0.030 | 360 | 0.025 | 364 | 0.286 | — | 0 |
| 389 | (s) | 275 | 0.183 | 386 | 0.004 | 185 | 12.45 | 389 | (s) | 274 | 0.183 | 385 | 0.004 | 182 | 12.45 | 219 | 0.119 |
| — | 0 | 356 | 0.040 | — | 0 | 349 | 0.417 | — | 0 | 354 | 0.040 | — | 0 | 348 | 0.417 | — | 0 |
| 358 | 0.004 | 378 | 0.014 | 351 | 0.033 | 373 | 0.131 | 357 | 0.004 | 378 | 0.014 | 349 | 0.033 | 373 | 0.131 | 182 | 0.639 |
| 359 | 0.004 | 344 | 0.059 | 380 | 0.005 | 367 | 0.268 | 351 | 0.004 | 342 | 0.059 | 381 | 0.005 | 367 | 0.268 | — | NA |
| 336 | 0.009 | 351 | 0.046 | 345 | 0.046 | 361 | 0.328 | 335 | 0.009 | 349 | 0.046 | 342 | 0.046 | 360 | 0.328 | — | 0 |
| 253 | 0.041 | — | 0 | 264 | 0.264 | — | 0 | 246 | 0.041 | — | 0 | 259 | 0.264 | — | 0 | — | 0 |
| 357 | 0.004 | 300 | 0.126 | 370 | 0.016 | 333 | 0.561 | 358 | 0.004 | 299 | 0.126 | 369 | 0.016 | 333 | 0.561 | 217 | 0.150 |
| 339 | 0.009 | 352 | 0.043 | 352 | 0.033 | 342 | 0.437 | 336 | 0.009 | 350 | 0.043 | 348 | 0.033 | 342 | 0.437 | 212 | 0.180 |
| 385 | 0.001 | 381 | 0.012 | 365 | 0.023 | 387 | 0.060 | 383 | 0.001 | 381 | 0.012 | 363 | 0.023 | 387 | 0.060 | 167 | 1.063 |
| | 3,444.9 | | 14,040.3 | | 34,602.4 | | 166,040.3 | | 2,145.1 | | 10,337.9 | | 22,437.4 | | 109,841.4 | | 8,462.3 |

net income consists of nonrecurring gain of $2,635,000. 48. Subsidiary of ENERGEN. 49. Includes coalbed methane reserves. 50. Apache Corp. owns 4%. 51. Subsidiary of Coho Resources Ltd. 52. Subsidiary of Public Service Co. of Colorado. 53. Subsidiary of Penn Virginia Corp. 54. Subsidiary of MDU Resources Group, Inc. 55. Formerly Texas International Co., reorganized due to voluntary bankruptcy petition filing. 56. Fiscal yearend Feb. 28, 1990. 57. Formerly Kencope Energies, Inc. 58. Distributable cash. 59. Formerly Chapman Energy. 60. Energy Development Partners Ltd. owns 69%. 61. Financial data has been converted from Canadian dollars. 62. Formerly Mustang Resources Corp; emerged from Chapter 11. 63. Name changed from Resource Exploration Inc. 64. Subsidiary of DEMINEX Deutsche Erdolversorgungsgesellschaft mbH. 65. Fiscal yearend Oct. 31. 66. Fiscal yearend July 31. 67. Fiscal yearend Nov. 30. 68. Formerly listed as Kimbark Oil & Gas. 69. Fiscal yearned March 31, 1990 used because annual report released early, and the company had significant changes. 70. Company has merged with Crystal Oil as of 12-5-89. 71. Subsidiary of Eglinton Exploration plc. 72. Includes reserve for foreign currency fluctuation. 73. Formerly U.S. Mineral & Royalty Corp. 74. Snyder Oil Co. owns 39% of outstanding common stock. 75. Fiscal yearend April 30. 76. Formerly Trans Western Exploration; emerged from bankruptcy 8-29-87. 77. U.S. operating subsidiary of Roxana Resources Ltd. in Canada. 78. Subsidiary of WICOR Inc. 79. Trust was terminated 1-31-90. 80. Canadian chartered oil and gas exploration company operating exclusively in the U.S. 81. Commenced operations in September 1988, became public March 1989. 82. Formerly Strata Corp. 83. Formerly Republic Resources Corp. 84. Majority interest in company owned by Petro Imperial Corp. 85. Oil and gas are combined and stated in bcf equivalent. 86. Majority owned subsidiary of Aleph Inc. 87. The proposed name change is Camelot Corp. 88. U.S. operating subsidiary of Morrison Petroleums Ltd. 89. Formerly Petrotech, Inc. 90. Primary line of business is medical product sales.

## *Leading oil and gas companies around the world*

| Country | Company | Total assets | | Total revenues | | Total net income | | Capital and exploratory expenditures | |
|---|---|---|---|---|---|---|---|---|---|
| | | Million $ | | | | | | | |
| | | 1989 | 1988 | 1989 | 1988 | 1989 | 1988 | 1989 | 1988 |
| **CANADA** | | | | | | | | | |
| Canada | **Alberta Energy Co. Ltd.** | 2,319.5 | 1,619.3 | 606.9 | 390.9 | 44.2 | 41.8 | 233.8 | 129.2 |
| Canada | **Amoco Canada Petroleum Co. Ltd.** | 7,789.7 | [3] 6,071.9 | 4,093.1 | 1,690.1 | (240.4) | (42.3) | 521.0 | 283.7 |
| Canada | **Bow Valley Industries Ltd.** | 1,501.7 | 1,114.9 | 344.8 | 217.6 | 30.4 | 8.4 | 229.7 | 407.2 |
| Canada | **BP Canada Inc.** | 1,039.2 | 736.7 | 401.6 | 249.4 | 21.2 | 8.4 | 184.6 | 229.7 |
| Canada | **Canada Northwest Energy Ltd.** [6] | 522.7 | 391.3 | 104.0 | 91.2 | (8.4) | (91.1) | 70.7 | 71.3 |
| Canada | **Canadian Hunter Exploration Ltd.** [7] | 795.1 | 449.3 | 152.3 | 94.2 | 5.0 | 1.9 | 263.6 | 102.8 |
| Canada | **Canadian Occidental Petroleum Ltd.** | 1,623.8 | 1,136.9 | 700.0 | 601.3 | 48.1 | 43.3 | (193.4) | (119.0) |
| Canada | **Canadian Roxy Petroleum Ltd.** | 221.6 | 159.7 | 28.9 | 17.2 | 0.3 | (0.8) | 19.2 | 11.2 |
| Canada | **Canadian Western Natural Gas Co. Ltd.** | 511.1 | 334.0 | 350.9 | 242.1 | 24.8 | 16.0 | 36.5 | 22.2 |
| Canada | **Chevron Canada Resources** | 1,598.1 | 918.6 | 1,039.4 | 643.5 | 162.4 | 88.4 | 460.1 | 299.4 |
| Canada | **Conwest Exploration Co. Ltd.** | 441.4 | 292.6 | 122.2 | 79.4 | 12.2 | 10.3 | 54.8 | 12.8 |
| Canada | **Encor Inc.** | 1,708.8 | 1,447.4 | 456.7 | 296.7 | (42.6) | (90.1) | 104.4 | 126.0 |
| Canada | **Gulf Canada Resources Ltd.** | 3,846.2 | [9] 3,104.7 | 1,081.0 | 703.2 | 54.5 | 54.5 | 395.5 | 307.3 |
| Canada | **Husky Oil Operations** | 4,295.4 | 3,420.8 | 947.2 | 491.8 | 1.2 | 0.8 | 296.0 | 166.6 |
| Canada | **Imperial Oil Ltd.** | 18,033.9 | 8,079.9 | 11,963.1 | 5,857.1 | 539.9 | 407.3 | [10] 1,031.3 | [10] 777.2 |
| Canada | **Interhome Energy Inc.** | 3,596.7 | 2,513.9 | 1,031.6 | 697.7 | 154.6 | 97.0 | 385.5 | 283.8 |
| Canada | **Numac Oil & Gas Ltd.** | 387.9 | 258.7 | 51.5 | 35.1 | 1.8 | 3.6 | 77.7 | 35.7 |
| Canada | **Mark Resources Inc.** | 579.6 | 372.7 | 89.0 | 47.6 | 0.5 | 1.8 | 76.5 | 42.9 |
| Canada | **Norcen Energy Resources Ltd.** | 3,023.0 | 1,941.0 | 1,000.5 | 595.1 | 130.2 | 74.8 | 427.4 | 201.6 |
| Canada | **PanCanadian Petroleum Ltd.** | 3,167.5 | 2,241.9 | 935.4 | 561.2 | 157.5 | 101.2 | 358.3 | [11] 590.4 |
| Canada | **Petro-Canada** | 7,893.9 | 5,661.1 | 5,940.1 | 3,902.8 | 36.7 | (26.8) | 671.3 | 649.5 |
| Canada | **Placer Dome Inc.** | 428.7 | 372.8 | 1,197.4 | 748.6 | 148.1 | 213.3 | NA | 40.5 |
| Canada | **Ranger Oil Ltd.** | 564.8 | 458.6 | 132.9 | 94.7 | 51.9 | 15.4 | 109.5 | 98.8 |
| Canada | **Saskatchewan Oil & Gas Corp.** | 1,197.2 | 528.6 | 263.0 | 93.6 | 30.5 | (7.1) | 147.1 | 67.7 |
| Canada | **Sceptre Resources Ltd.** | 893.7 | 399.7 | 190.1 | 74.1 | (28.6) | 5.1 | 88.9 | 49.1 |
| Canada | **Shell Canada Ltd.** | 6,562.4 | 4,707.8 | 5,821.7 | 4,113.4 | 251.0 | 347.1 | 844.2 | 360.1 |
| Canada | **Sunoco Inc.** | 2,371.2 | 1,696.1 | 1,761.8 | 1,093.4 | 58.0 | (39.8) | 166.9 | 174.0 |
| Canada | **Teck Corp.** | 1,183.4 | [14] 855.8 | 490.5 | 282.4 | 133.7 | 89.8 | 63.0 | 51.4 |
| Canada | **Total Petroleum (North America) Ltd.** | 1,153.1 | 807.3 | 2,170.6 | 1,490.5 | 48.2 | 59.1 | 234.9 | 95.0 |
| Canada | **Westcoast Petroleum Ltd.** | 965.6 | 635.7 | 150.4 | 88.8 | 30.9 | 14.5 | 150.6 | 59.5 |
| **LATIN AMERICA** | | | | | | | | | |
| Argentina | **Yacimientos Petroliferos Fiscales SA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Bolivia | **Yacimientos Petroliferos Fiscales Bolivianos** | [15] 560.0 | [15] 527.0 | [15] 252.0 | [15] 237.0 | [15] 208.0 | [15] 196.0 | [15] 790.0 | [15] 746.0 |
| Brazil | **Petroleo Brasileiro SA** | 16,065.5 | 13,691.6 | 15,436.0 | 14,500.0 | 128.0 | 265.0 | 2,372.0 | 2,560.0 |
| Chile | **Empresa Nacional del Petroleo** | NA | NA | NA | NA | NA | NA | NA | NA |
| Colombia | **Empresa Colombiana de Petroleos** | NA | NA | NA | NA | NA | NA | NA | NA |
| Ecuador | **Petroleos del Ecuador** | NA | NA | NA | NA | NA | NA | NA | NA |
| Guatemala | **Ministry of Energy and Mines** | NA | NA | NA | NA | NA | NA | NA | NA |
| Mexico | **Petroleos Mexicanos** | 42,378.6 | 46,155.0 | 15,114.0 | 13,125.6 | 298.8 | 574.7 | 1,651.1 | 2,035.3 |
| Peru | **Petroleos del Peru SA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Suriname | **State Oil Co. Suriname NV** | 41.8 | 32.7 | 19.6 | 13.7 | 2.0 | 0.7 | 14.8 | 4.2 |
| Venezuela | **Petroleos de Venezuela SA** | 29,907.0 | 27,255.0 | 13,752.7 | 9,512.7 | 2,111.6 | 801.1 | 4,791.8 | 3,884.1 |
| **WESTERN EUROPE** | | | | | | | | | |
| Austria | **OMV Aktiengesellschaft** | 3,041.3 | 2,770.8 | 2,557.4 | 2,577.3 | 26.2 | 21.4 | 161.0 | 336.2 |
| Belgium | **Petrofina SA** | 10,305.8 | 9,440.4 | 15,043.4 | 13,640.1 | 554.5 | 550.3 | 1,205.4 | 1,758.1 |
| Finland | **Neste Corp.** | 8,486.0 | 6,569.0 | 8,612.0 | 6,575.0 | 461.0 | 329.0 | 830.0 | 910.0 |
| France | **Eurafrep** | 38.6 | 33.4 | 47.0 | 34.8 | 7.1 | 3.4 | 14.4 | 17.7 |
| France | **Gaz de France** | 10,937.5 | 10,260.7 | 6,148.7 | 6,390.8 | (7.1) | 13.0 | 683.7 | 712.1 |
| France | **Ste. Nat. Elf Aquitaine** | 33,181.4 | 28,036.7 | 24,872.3 | 22,604.3 | 1,132.7 | 1,212.1 | 4,331.0 | 4,058.0 |
| France | **Total CFP** | 15,273.0 | 14,515.1 | 16,932.2 | 14,012.2 | 423.7 | 328.9 | 1,365.2 | 2,414.5 |
| France | **Trapil** | 89.3 | 86.6 | 80.3 | 85.6 | 8.1 | 9.2 | 6.7 | 5.3 |
| Germany, West | **Deminex** | 1,709.3 | 1,617.1 | 711.6 | 503.8 | 61.8 | (35.4) | 361.1 | 416.0 |
| Germany, West | **Wintershall AG** | 1,556.0 | 1,296.8 | 1,786.8 | 2,077.8 | 120.6 | (164.3) | 578.4 | 391.4 |
| Italy | **Ente Nazionale Idrocarburi** | 25,420.1 | 22,527.3 | 26,584.4 | 25,284.5 | 1,175.9 | 1,008.7 | 4,625.5 | 4,511.4 |
| Netherlands | **Royal Dutch/Shell** | 90,193.0 | 85,280.0 | 106,090.0 | 99,445.0 | 6,539.0 | 5,234.0 | 10,111.0 | 9,257.0 |
| Norway | **Norsk Hydro AS** | 11,265.9 | 11,267.4 | [20] 9,613.5 | [20] 9,224.2 | 389.4 | 527.7 | 1,316.9 | 1,357.8 |
| Norway | **Saga Petroleum SA** | 1,782.7 | 1,641.2 | 443.4 | 224.8 | 28.6 | 7.8 | 226.0 | 251.3 |

| Worldwide oil production Million bbl 1989 | 1988 | Worldwide natural gas production Bcf 1989 | 1988 | Worldwide oil reserves Million bbl 1989 | 1988 | Worldwide natural gas reserves Bcf 1989 | 1988 |
|---|---|---|---|---|---|---|---|
| [1]2.3 | [1]2.4 | [1]99.3 | [1]102.2 | [2]15.9 | 15.5 | 1,412.0 | 1,539.0 |
| 36.0 | 24.9 | 302.4 | 199.7 | 369.0 | 399.0 | 4,566.0 | 4,901.0 |
| [4]12.6 | [4]14.0 | [4]65.4 | [4]51.5 | [4]74.8 | [4]71.2 | [4]1,028.4 | [4]974.6 |
| [5]8.7 | [5]8.7 | 55.7 | 48.2 | [5]162.9 | [5]183.4 | 774.2 | 783.2 |
| 4.7 | 5.5 | 10.4 | 10.5 | 67.8 | 93.6 | 229.9 | 213.1 |
| 3.0 | 2.6 | 59.5 | 58.0 | 46.7 | 43.5 | 753.0 | 642.0 |
| [6]8.2 | [6]8.8 | 77.5 | 74.5 | [6]56.0 | [6]61.8 | 868.6 | 839.2 |
| [2]1.0 | [2]1.0 | 5.2 | 4.3 | [2]12.1 | [2]12.9 | 103.7 | 109.7 |
| 0.0 | 0.0 | 3.8 | 4.0 | 0.3 | 0.3 | 124.9 | 129.9 |
| 32.4 | 33.6 | 75.5 | 70.2 | 217.0 | 228.0 | 1,117.0 | 1,118.0 |
| 1.2 | 0.8 | 5.7 | 5.1 | 14.6 | 10.8 | 111.3 | 85.6 |
| 14.7 | 15.4 | 76.7 | 74.1 | 129.5 | 164.5 | 1,170.0 | 1,355.0 |
| 25.7 | 26.4 | 135.7 | 136.3 | 201.0 | 209.0 | 1,536.0 | 1,572.0 |
| 20.1 | 18.3 | 85.8 | 43.8 | 260.0 | 230.0 | 1,570.0 | 1,590.0 |
| 126.8 | 97.6 | 262.8 | 143.0 | 2,264.0 | 1,949.0 | 5,087.0 | 3,113.0 |
| 9.6 | 10.0 | 55.0 | 54.2 | 88.4 | 93.8 | 1,193.2 | 1,050.3 |
| 1.7 | 1.9 | 5.1 | 4.5 | 12.2 | 8.5 | 132.4 | 117.4 |
| 2.7 | 2.4 | 24.3 | 19.2 | 25.5 | 25.2 | 553.1 | 489.1 |
| 17.2 | 16.4 | 74.5 | 66.8 | 173.0 | 134.0 | 1,625.0 | 1,165.0 |
| [12]28.8 | [12]26.5 | [12]141.0 | [12]149.0 | [12]349.5 | [12]355.8 | [12]2,250.0 | [12]2,322.0 |
| [12]36.6 | [12]38.4 | [12]208.3 | [12]167.9 | [12]527.3 | [12]581.7 | [12]3,340.0 | [12]3,474.0 |
| 2.8 | 2.7 | 13.5 | 11.1 | NA | 16.4 | NA | 193.1 |
| 5.6 | 4.6 | 10.0 | 7.5 | 33.7 | 31.4 | 152.3 | 99.8 |
| 7.7 | 6.6 | 63.7 | 21.1 | 90.7 | 62.2 | 941.9 | 569.5 |
| 6.6 | 3.3 | 56.7 | 38.8 | 49.1 | 20.5 | 677.8 | 445.2 |
| [2]17.4 | [2]19.7 | 189.5 | 186.9 | [2]152.2 | [13]140.9 | [13]3,447.2 | [13]3,341.3 |
| 3.3 | 3.9 | 24.5 | 23.4 | 32.0 | 35.0 | 297.0 | 295.0 |
| 0.5 | 0.5 | 3.0 | 2.9 | NA | 4.5 | NA | 48.0 |
| [2]3.1 | [2]3.2 | [1]13.1 | [1]12.7 | 23.4 | 24.8 | 354.7 | 323.6 |
| 5.7 | 5.6 | 21.9 | 21.6 | 48.7 | 52.7 | 631.1 | 626.9 |
| | | | | | | | |
| 167.2 | 161.1 | 846.2 | 757.4 | 2,279.9 | 2,268.0 | 27,294.0 | 26,700.0 |
| 7.3 | 7.0 | 186.8 | 169.9 | 119.2 | 176.0 | 4,148.7 | 5,474.7 |
| 225.1 | 210.6 | 215.9 | 205.6 | 2,793.3 | 2,832.4 | 4,094.9 | 3,845.2 |
| 8.0 | 8.9 | 36.1 | 56.3 | 300.0 | 287.0 | 4,200.0 | 4,200.0 |
| 147.0 | 137.5 | 177.3 | 176.3 | 1,947.0 | 2,200.0 | 4,209.0 | 4,209.0 |
| 101.8 | 69.9 | 3.6 | 3.6 | 1,514.0 | 635.0 | 3,990.0 | 4,020.0 |
| 1.3 | 1.3 | 0.3 | 0.4 | 37.5 | 25.2 | 10.0 | 10.0 |
| 917.4 | 917.4 | 1,303.7 | 1,273.1 | 51,983.0 | 53,012.0 | 72,744.0 | 73,356.0 |
| 47.6 | 51.7 | 39.8 | 46.9 | 405.9 | 412.0 | 781.9 | 777.7 |
| 1.4 | 1.2 | 0.0 | 0.0 | 32.5 | 32.5 | 0.0 | 0.0 |
| 696.3 | 694.6 | 1,419.9 | 1,374.7 | 59,041.0 | 58,504.0 | 105,688.7 | 100,846.0 |
| | | | | | | | |
| 11.7 | 11.0 | 28.1 | 25.8 | 167.9 | 179.6 | 441.3 | 469.5 |
| 43.0 | 41.5 | 199.6 | 151.3 | [16]772.0 | [16]754.0 | 0.0 | 0.0 |
| 1.8 | 1.5 | NA | NA | 10.0 | 8.5 | NA | NA |
| 1.7 | 1.0 | 261.5 | 208.3 | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 249.7 | 235.5 | 822.8 | 829.9 | 1,789.0 | 1,416.3 | 4,838.1 | 5,050.0 |
| 140.9 | 121.7 | 237.4 | 229.5 | [17]463.6 | [17]462.1 | [17]5,672.4 | [17]5,014.0 |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 35.3 | 29.5 | 13.8 | 13.2 | [18]727.0 | [18]775.0 | 462.0 | 513.0 |
| 21.0 | 20.2 | 68.6 | 76.1 | NA | NA | NA | NA |
| 157.6 | 139.3 | 621.5 | 617.9 | [19]5,158.0 | [19]4,573.9 | 0.0 | 0.0 |
| 676.0 | 645.0 | 2,142.0 | 2,209.0 | 9,496.0 | 8,839.0 | 40,356.0 | 38,687.0 |
| 28.8 | 14.1 | 114.4 | 115.5 | 587.0 | 587.0 | 4,591.6 | 4,679.9 |
| [1]17.6 | [1]8.4 | 8.4 | 7.4 | 445.3 | NA | 2.7 | NA |

## Leading oil and gas companies around the world

| Country | Company | Total assets | | Total revenues | | Total net income | | Capital and exploratory expenditures | |
|---|---|---|---|---|---|---|---|---|---|
| | | Million $ | | | | | | | |
| | | 1989 | 1988 | 1989 | 1988 | 1989 | 1988 | 1989 | 19 |
| Norway | **Statoil** | NA | 7,118.0 | NA | 5,789.0 | NA | 61.2 | NA | 1,374.7 |
| Norway | **Total Marine Norsk AS** | 600.2 | 609.5 | 349.7 | 323.5 | 53.1 | 43.7 | 38.0 | 62.7 |
| Spain | **Repsol SA** | 8,916.7 | 6,391.4 | 9,762.3 | 8,102.7 | 545.0 | 481.1 | 865.2 | 532.0 |
| Turkey | **Turkish Petroleum Corp.** | 767.3 | 755.9 | 224.7 | 147.2 | [21] 173.2 | [21] 238.9 | 132.1 | 136.4 |
| U.K. | **British Gas plc** | 34,014.1 | 36,741.9 | 2,789.1 | 2,736.2 | 1,011.7 | 1,013.6 | 1,383.9 | 798.0 |
| U.K. | **British Petroleum Co. plc** | 50,900.0 | 53,075.0 | 61,326.0 | 58,920.0 | 3,500.0 | 2,154.0 | 5,630.0 | 5,837.0 |
| U.K. | **Burmah Oil plc** | 1,147.0 | 1,150.8 | 3,367.1 | 3,287.5 | 1,867.6 | 162.8 | 146.3 | 115.4 |
| U.K. | **Clyde Petroleum plc** | 615.4 | 608.9 | 96.4 | 71.9 | 21.9 | 8.1 | 76.3 | 56.7 |
| U.K. | **Hamilton Bro. Oil & Gas Ltd.** | 761.2 | 838.5 | 207.9 | 195.2 | 38.6 | 29.3 | 91.8 | 71.9 |
| U.K. | **Lasmo plc** | 2,581.5 | 2,029.5 | 434.6 | 268.0 | 98.8 | 399.3 | [23] 806.3 | [23] 211.0 |
| U.K. | **Sovereign Oil & Gas plc** | 125.3 | 134.3 | 20.1 | 25.3 | 0.8 | 1.9 | 21.2 | 14.6 |
| U.K. | **Ultramar plc** | 3,661.0 | 3,477.0 | 2,830.0 | 1,950.0 | 165.0 | 164.0 | 313.0 | 166.0 |
| **AFRICA** | | | | | | | | | |
| Algeria | **Sonatrach** | NA | NA | NA | NA | NA | NA | NA | NA |
| Benin | **Projet Petrolier Seme-Ashland** | NA | 57.5 | 21.0 | 24.6 | NA | 21.6 | 12.3 | 6.5 |
| Libya | **National Oil Corp.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Nigeria | **Nigerian National Petrol. Corp.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Tunisia | **Entreprise Tunisienne Activites Petrolieres** | 412.5 | 321.7 | 138.8 | 90.8 | 23.7 | 10.5 | 16.2 | 17.9 |
| **MIDDLE EAST** | | | | | | | | | |
| Abu Dhabi | **Abu Dhabi National Oil Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Bahrain | **Bahrain National Oil Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Dubai | **Dubai Petroleum Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Iran | **National Iranian Oil Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Iraq | **Iraq National Oil Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Kuwait | **Kuwait Petroleum Corp.** | 23,079.0 | 21,411.0 | 12,738.5 | 12,294.6 | 717.3 | 432.8 | 976.4 | 989.9 |
| Oman | **Petroleum Development Oman** | NA | NA | NA | NA | NA | NA | NA | NA |
| Qatar | **Qatar General Pet. Corp.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Saudi Arabia | **Saudi Arabian Oil Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| Syria | **Syrian Petroleum Co.** | NA | NA | NA | NA | NA | NA | NA | NA |
| **ASIA PACIFIC** | | | | | | | | | |
| Australia | **BHP Petroleum Pty Ltd.** | 5,793.6 | 5,151.7 | 2,131.8 | 2,309.4 | 268.0 | 285.5 | 601.8 | 527.5 |
| Australia | **Bridge Oil Ltd.** | 552.6 | 500.9 | 101.6 | 51.2 | 15.9 | 19.1 | 42.2 | 18.4 |
| Australia | **Crusader Ltd.** | 188.7 | 196.2 | 83.5 | 76.8 | 9.6 | 6.4 | 12.9 | 17.6 |
| Australia | **Meridian Oil NL** | NA | 6.2 | NA | 0.0 | NA | NA | NA | 0.9 |
| Australia | **Petroz NL** | 38.0 | 109.0 | 28.8 | 79.0 | 16.8 | (76.1) | 9.4 | 9.3 |
| Australia | **Santos Ltd.** | 2,323.9 | 2,437.3 | 477.9 | 365.1 | [24] 94.2 | [24] 6.2 | 177.4 | 118.7 |
| Brunei | **Petroleum Unit** | NA | NA | NA | NA | NA | NA | NA | NA |
| China | **China National Offshore Oil Corp.** | 440.6 | 518.4 | 95.7 | 78.9 | 2.0 | 2.9 | 49.8 | 36.1 |
| India | **Oil & Natural Gas Commission** | NA | NA | NA | NA | NA | NA | NA | NA |
| Indonesia | **Pertamina** | [25] 10,635.4 | [25] 7,332.3 | 8,740.2 | 8,851.9 | 451.7 | 368.6 | 5,973.2 | 5,951.2 |
| Japan | **Idemitsu Kosan Co. Ltd.** | 9,111.5 | 9,982.4 | 10,856.2 | 12,175.7 | 10.0 | 10.0 | NA | NA |
| Korea | **Yukong Ltd.** | 2,735.0 | 1,883.8 | 3,885.0 | 3,379.1 | 98.0 | 84.8 | 950.0 | 384.0 |
| Malaysia | **Petronas** | NA | 8,046.9 | NA | 2,588.8 | NA | 854.9 | NA | 158.5 |
| New Zealand | **New Zealand Oil & Gas Ltd.** | 55.7 | 25.8 | 11.7 | 17.7 | 12.3 | 6.9 | 19.5 | 10.4 |
| New Zealand | **Southern Petroleum NL** | 35.1 | 33.9 | 8.5 | 10.0 | 0.6 | 2.4 | 26.2 | 27.9 |
| Philippines | **Philippine National Oil Co.** | 1,513.7 | 1,275.2 | 981.5 | 974.0 | 72.8 | 60.5 | 79.9 | 35.6 |
| Taiwan (China) | **Chinese Petroleum Corp.** [27] | 9,406.0 | 8,448.5 | 7,275.6 | 7,319.1 | 1,673.0 | 1,824.8 | 1,087.8 | 1,043.2 |
| Thailand | **Petroleum Authority of Thailand** | 1,465.6 | 1,431.1 | 1,779.7 | 1,635.2 | 1,510.5 | 1,515.0 | 1,695.7 | 1,522.5 |

NA = Not available. Fiscal yearend is Dec. 31 unless otherwise noted. 1. Sales. 2. Includes NGL. 3. Includes 4 months of dome petroleum 4. Gross. 5. Includes Bitumen. 6. Fiscal yearends Sept. 30. 7. Includes American Hunter Exploration Ltd. 8. Excludes synthetic crude oil. 9. Restated, aquisition of Asamera Inc. 10. Exclude acquisitions. 11. Includes $438.3 million for net prop. acquisitions 12. Before royalties. 13. Developed & undeveloped. 14. Changed fiscal yearend contains 15 mths. 15. Estimated. 16. Includes crude oil, condensate & natural gas. 17. Outside Middle East. 18. Proven

| Worldwide oil production Million bbl | | Worldwide natural gas production Bcf | | Worldwide oil reserves Million bbl | | Worldwide natural gas reserves Bcf | |
|---|---|---|---|---|---|---|---|
| 1989 | 1988 | 1989 | 1988 | 1989 | 1988 | 1989 | 1988 |
| NA | 128.3 | NA | 98.9 | NA | 1,100.1 | NA | 1,638.4 |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 51.4 | 48.3 | 44.7 | 25.4 | 418.1 | 381.0 | 172.7 | 296.3 |
| 12.9 | 10.3 | 6.1 | 3.5 | NA | NA | NA | NA |
| 16.4 | 0.8 | 115.0 | 133.0 | 156.9 | 86.0 | 7,079.0 | 6,070.0 |
| 515.4 | 567.3 | 438.0 | 321.0 | 4,922.0 | 5.224.0 | 11,444.0 | 11,813.0 |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 4.0 | 4.8 | 17.2 | 4.6 | [22]115.5 | [22]116.0 | [22]392.0 | [22]334.9 |
| 2.1 | 1.9 | 52.7 | 47.6 | 59.3 | 58.5 | 922.1 | 975.1 |
| 23.8 | 17.8 | 13.4 | 8.2 | 391.4 | 215.2 | 0.4 | 0.3 |
| 1.2 | 1.6 | NA | NA | 62.0 | NA | 140.0 | NA |
| 10.2 | 10.0 | 168.2 | 158.0 | 46.2 | 52.6 | 2,299.5 | 2,268.4 |
| 260.6 | 228.4 | 2,316.5 | 1,542.4 | 9,200.0 | 8,400.0 | 114,000.0 | 104,200.0 |
| 1.3 | 1.6 | NA | NA | 19.9 | 19.9 | NA | NA |
| 412.5 | 325.6 | 182.0 | 198.0 | 22,800.0 | 22,000.0 | 25,500.0 | 25,700.0 |
| 610.3 | 507.4 | 135.0 | 126.0 | 16,000.0 | 16,000.0 | 87,400.0 | 85,000.0 |
| 7.1 | 5.9 | 13.0 | 13.1 | 64.8 | 44.7 | 0.2 | 0.2 |
| 536.6 | 378.6 | 550.9 | 461.9 | 92,205.0 | 92,205.0 | 182,900.0 | 183,500.0 |
| 15.7 | 15.7 | 193.9 | 184.9 | 111.7 | 126.0 | 6,476.0 | 6,700.0 |
| 157.3 | 132.8 | 80.5 | 95.2 | 4,000.0 | 4,000.0 | 4,900.0 | 5,015.0 |
| 1,075.7 | 819.8 | 793.9 | 620.0 | 92,860.0 | 92,850.0 | 500,000.0 | 494,400.0 |
| 1,051.4 | 983.8 | 201.8 | 110.4 | 100,000.0 | 100,000.0 | 95,000.0 | 95,000.0 |
| 581.4 | 439.2 | 222.9 | 174.6 | 94,525.0 | 91,920.0 | 48,600.0 | 42,500.0 |
| 223.7 | 221.4 | 80.4 | 73.2 | 4,250.0 | 4,071.0 | 9,260.0 | 9,320.0 |
| 141.3 | 126.6 | 256.3 | 204.2 | 4,500.0 | 3,150.0 | 163,100.0 | 156,700.0 |
| 1,823.2 | 1,803.7 | 1,079.8 | 899.3 | 254,959.0 | 169,970.0 | 181,347.0 | 145,848.0 |
| 124.1 | 93.4 | 24.5 | 22.2 | 1,730.0 | 1,730.0 | 4,000.0 | 13,130.0 |
| 75.8 | 82.9 | 175.2 | 160.4 | 638.0 | 675.0 | 6,032.0 | 5,607.0 |
| 3.0 | 1.9 | 4.6 | 2.2 | [22]32.7 | [22]31.6 | [22]43.3 | [22]46.2 |
| 1.3 | 1.1 | 14.4 | 13.6 | 5.5 | 5.4 | 123.7 | 123.0 |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 0.3 | 0.6 | 3.1 | 3.1 | 3.4 | 2.3 | 308.8 | 55.3 |
| 13.4 | 10.9 | 107.9 | 96.1 | [22]117.5 | [22]114.1 | [22]2,433.3 | [22]2,186.8 |
| 54.8 | 54.8 | 323.0 | 317.9 | 1,375.0 | 1,400.0 | 11,370.0 | 11,600.0 |
| 0.7 | 0.6 | NA | NA | 6,335.9 | 5,963.2 | 42.4 | 42.4 |
| 246.7 | 232.0 | 374.4 | 312.3 | 7,516.4 | 6,354.0 | 22,973.0 | 22,861.0 |
| 514.3 | 491.5 | 1,805.4 | 1,846.9 | [26]11,055.0 | [26]10,318.0 | [26]91,458.0 | [26]83,590.0 |
| NA | NA | NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 205.5 | 191.1 | 526.0 | 590.7 | 2,950.0 | 2,900.0 | 51,900 | 51,700.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 3.4 | 0.9 | 21.3 | 3.3 |
| NA | NA | NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA | NA | NA |
| 1.0 | 1.2 | 42.2 | 40.0 | NA | NA | NA | NA |
| 12.1 | 13.9 | 193.1 | 188.7 | 230.0 | 230.0 | 7,418.4 | 7,418.4 |

and probable, based on working interest. 19. Oil & natural gas. 20. Operating revenue. 21. Before tax. 22. Proven & Probable. 23. Includes acquisition of Hudbay Oil. 24. Operating profit. 25. As of March 31. 26. As of Jan. 15. 27. Exchange rate end of year.

# The OGJ400 Company Index

| Rank by total assets | Company name | Headquarters city |
|---|---|---|
| 192 | **Adams Resources & Energy Inc.** | Houston |
| 64 | **Adobe Resources Corp.** | New York |
| 1 | **Alamco, Inc.** | Clarksburg, W.Va. |
| 161 | **Alexander Energy Corp.** | Oklahoma City |
| 87 | **Allegheny & Western Energy Corp.** | Charleston, W.Va. |
| 267 | **Alta Energy Corp.** | Midland |
| 321 | **Altex Industries, Inc.** | Denver |
| 384 | **Amacan Resources Corp.** | Salt Lake City |
| 81 | **AMAX Oil & Gas Inc.** | Houston |
| 282 | **Amber Resources Co.** | Denver |
| 16 | **Amerada Hess Corp.** | New York |
| 77 | **American Exploration Co.** | Houston |
| 201 | **American International Petroleum Corp.** | New York |
| 140 | **American National Petroleum Co.** | Houston |
| 28 | **American Petrofina Inc.** | Dallas |
| 4 | **Amoco Corp.** | Chicago |
| 36 | **Anadarko Petroleum Corp.** | Houston |
| 52 | **Apache Corp.** | Denver |
| 130 | **Apache Offshore Investment Partnership** | Denver |
| 333 | **Appalachian Oil & Gas Co., Inc.** | Chattanooga, Tenn. |
| 202 | **Arch Petroleum Inc.** | Fort Worth |
| 7 | **ARCO (Atlantic Richfield Corp.)** | Los Angeles |
| 22 | **Arkla, Inc.** | Shreveport |
| 20 | **Ashland Oil Inc.** | Ashland, Ky. |
| 360 | **Aspen Exploration Corp.** | Denver |
| 94 | **Avalon Corp.** | New York |
| 173 | **Barrett Resources Corp.** | Denver |
| 193 | **Baruch-Foster Corp.** | Dallas |
| 288 | **Basic Earth Science Systems, Inc.** | Englewood, Colo. |
| 96 | **Beard Oil Co.** | Oklahoma City |
| 184 | **Belcor Inc.** | Irvine, Calif. |
| 174 | **Belden & Blake Energy Co.** | North Canton, Ohio |
| 222 | **Bellwether Exploration Co.** | Houston |
| 278 | **Benton Oil & Gas Co.** | Ventura, Calif. |
| 93 | **Berry Petroleum Co.** | Taft, Calif. |
| 44 | **BHP Petroleum (Americas) Inc.** | Houston |
| 349 | **Big Piney Oil & Gas Co.** | Salt Lake City |
| 169 | **Blue Dolphin Energy Co.** | Houston |
| 301 | **Bogert 1986 - II L.P.** | Oklahoma City |
| 323 | **Bogert 1986 - IV L.P.** | Oklahoma City |
| 141 | **Bogert Oil Co.** | Oklahoma City |
| 378 | **Bolyard Oil & Gas Ltd.** | Dallas |
| 9 | **BP America** | Cleveland |
| 90 | **Bridge Oil (U.S.A.) Inc.** | Dallas |
| 205 | **Brock Exploration Corp.** | New Orleans |
| 373 | **Broken Arrow Petroleum Co.** | Scottsdale, Ariz. |
| 293 | **BT Energy Corp.** | Independence, Ohio |
| 122 | **Buttes Gas & Oil Co.** | Houston |
| 38 | **Cabot Corp.** | Waltham, Mass. |
| 168 | **Callon Consolidated Partners L.P.** | Natchez, Miss. |
| 133 | **Calumet Industries Inc.** | Burnham, Ill. |
| 397 | **Carmel Energy Inc.** | Houston |
| 188 | **Caspen Oil Inc.** | Dallas |
| 156 | **Castle Energy Corp.** | Blue Bell, Pa. |
| 56 | **Cenex, Farmer's Union Central Exchange, Inc.** | St. Paul, Minn. |
| 307 | **Chaparral Resources Inc.** | Denver |
| 3 | **Chevron Corp.** | San Francisco |
| 253 | **Churchill Technology, Inc.** | Lakewood, Colo. |
| 144 | **Clinton Gas Systems, Inc.** | Columbus, Ohio |
| 15 | **Coastal Corp.** | Houston |
| 329 | **Coastal Strategies Income Fund A** | San Jose, Calif. |
| 322 | **Coastal Strategies Income Fund B** | San Jose, Calif. |
| 365 | **Coastal Strategies Income Fund C** | San Jose, Calif. |
| 255 | **Cobb Resources Corp.** | Albuquerque |
| 164 | **Coda Energy Inc.** | Dallas |
| 131 | **Coho Resources Inc.** | Calgary, Alta., Can. |
| 17 | **Columbia Gas System Inc.** | Wilmington, Del. |
| 226 | **Columbian Energy Co. L.P.** | Topeka, Kan. |
| 189 | **Columbus Energy Corp.** | Denver |
| 157 | **Comstock Resources, Inc.** | Dallas |
| 257 | **COM-TEK Resources Inc.** | Denver |
| 12 | **Conoco Inc.** | Houston |
| 88 | **Conquest Exploration Co.** | Houston |
| 19 | **Consolidated Natural Gas Co.** | Pittsburgh |
| 170 | **Convest Energy Partners Ltd.** | Houston |
| 227 | **Credo Petroleum Corp.** | Denver |
| 315 | **Crescent Oil & Gas Corp.** | Denver |
| 97 | **Crystal Oil Co.** | Shreveport |
| 262 | **Daleco Resources Corp.** | Los Angeles |
| 290 | **Dallas Oil & Minerals Inc.** | Fort Worth |
| 108 | **Damson Oil Corp.** | New York |
| 70 | **DEKALB Energy Co.** | Denver |
| 179 | **Deminex U.S. Oil Co.** | Dallas |
| 98 | **Devon Energy Corp.** | Oklahoma City |
| 187 | **DI Industries, Inc.** | Houston |
| 82 | **Diamond Shamrock Offshore Partners L.P.** | Dallas |
| 51 | **Diversified Energies, Inc.** | Minneapolis |
| 367 | **DOL Resources, Inc.** | Dallas |
| 211 | **Dorchester Hugoton, Ltd.** | Dallas |
| 339 | **Double Eagle Petroleum and Mining Co.** | Casper, Wyo. |
| 379 | **Eagle Exploration Co.** | Denver |
| 74 | **Edisto Resources Corp.** | Dallas |
| 224 | **Eglinton Oil & Gas Corp.** | Fort Worth |
| 176 | **Enercap Corp.** | Houston |
| 206 | **Energy Assets International Corp.** | Houston |
| 100 | **Energy Ventures Inc.** | Houston |
| 355 | **Enex 88-89 Income & Retire. Fund-Series 1,L.P.** | Kingwood, Tex. |
| 357 | **Enex 88-89 Income & Retire. Fund-Series 2,L.P.** | Kingwood, Tex. |
| 347 | **Enex 88-89 Income & Retire. Fund-Series 3,L.P.** | Kingwood, Tex. |
| 342 | **Enex 88-89 Income & Retire. Fund-Series 4,L.P.** | Kingwood, Tex. |
| 383 | **Enex Income and Retirement Fund-Series 1, L.P.** | Kingwood, Tex. |
| 374 | **Enex Income and Retirement Fund-Series 2, L.P.** | Kingwood, Tex. |
| 371 | **Enex Income and Retirement Fund-Series 3, L.P.** | Kingwood, Tex. |
| 285 | **Enex Oil & Gas Income Program II-1** | Kingwood, Tex. |
| 296 | **Enex Oil & Gas Income Program II-2** | Kingwood, Tex. |
| 313 | **Enex Oil & Gas Income Program II-3** | Kingwood, Tex. |
| 324 | **Enex Oil & Gas Income Program II-4** | Kingwood, Tex. |
| 328 | **Enex Oil & Gas Income Program II-5** | Kingwood, Tex. |
| 335 | **Enex Oil & Gas Income Program II-6** | Kingwood, Tex. |
| 316 | **Enex Oil & Gas Income Program II-7** | Kingwood, Tex. |
| 340 | **Enex Oil & Gas Income Program II-8** | Kingwood, Tex. |
| 375 | **Enex Oil & Gas Income Program II-9** | Kingwood, Tex. |
| 363 | **Enex Oil & Gas Income Program II-10** | Kingwood, Tex. |
| 377 | **Enex Oil & Gas Income Prog. III-Series 1, L.P.** | Kingwood, Tex. |
| 356 | **Enex Oil & Gas Income Prog. III-Series 2, L.P.** | Kingwood, Tex. |
| 337 | **Enex Oil & Gas Income Prog. III-Series 3, L.P.** | Kingwood, Tex. |
| 351 | **Enex Oil & Gas Income Prog. III-Series 4, L.P.** | Kingwood, Tex. |
| 299 | **Enex Oil & Gas Income Prog. III-Series 5, L.P.** | Kingwood, Tex. |
| 311 | **Enex Oil & Gas Income Prog. III-Series 6, L.P.** | Kingwood, Tex. |
| 331 | **Enex Oil & Gas Income Prog. III-Series 7, L.P.** | Kingwood, Tex. |
| 302 | **Enex Oil & Gas Income Prog. III-Series 6, L.P.** | Kingwood, Tex. |
| 310 | **Enex Oil & Gas Income Prog. IV-Series 1, L.P.** | Kingwood, Tex. |
| 325 | **Enex Oil & Gas Income Prog. IV-Series 2, L.P.** | Kingwood, Tex. |
| 305 | **Enex Oil & Gas Income Prog. IV-Series 3, L.P.** | Kingwood, Tex. |
| 369 | **Enex Oil & Gas Income Prog. IV-Series 4, L.P.** | Kingwood, Tex. |
| 158 | **Enex Program I Partners, L.P.** | Kingwood, Tex. |
| 166 | **Enex Resources Corp.** | Kingwood, Tex. |
| 14 | **Enron Corp.** | Houston |
| 25 | **Enserch Corp.** | Dallas |
| 46 | **Enserch Exploration Partners Ltd.** | Dallas |
| 42 | **Equitable Resources Inc.** | Pittsburgh |
| 126 | **Equity Oil Co.** | Salt Lake City |
| 200 | **Evergreen Resources Inc.** | Denver |
| 319 | **Exploration Co.** | San Antonio |
| 101 | **Exploration Co. of Louisiana, Inc.** | Lafayette, La. |
| 1 | **Exxon Corp.** | New York |
| 212 | **Falcon Oil & Gas Co., Inc.** | Odessa, Tex. |
| 147 | **Fidelity Oil Group** | Bismark, N.D. |
| 65 | **First Mississippi Corp.** | Jackson, Miss. |
| 308 | **Foreland Corp.** | Ogden, Utah |
| 66 | **Forest Oil Corp.** | Denver |
| 40 | **Freeport McMoRan Energy Partners** | New Orleans |
| 23 | **Freeport-McMoRan Inc.** | New Orleans |
| 163 | **Freeport-McMoRan Oil and Gas Royalty Trust** | Houston |
| 135 | **Fuel Resources Development Co. (FUELCO)** | Denver |
| 106 | **Fuel Resources Inc.** | Staten Island, N.Y. |
| 155 | **Garnet Resources Corp.** | Houston |
| 382 | **General Energy Resources & Technology Corp.** | Traverse City, Mich. |
| 151 | **Geodyne Resources, Inc.** | Tulsa |
| 250 | **GeoResources Inc.** | Williston, N.D. |
| 350 | **Gladstone Resources Inc.** | Dallas |
| 58 | **Global Marine Inc.** | Houston |
| 91 | **Global Natural Resources Inc.** | Houston |
| 245 | **Gold King Consolidated Inc.** | Denver |
| 248 | **Golden Oil Co.** | Houston |
| 341 | **Golden Triangle Royalty & Oil, Inc.** | Cisco, Tex. |
| 50 | **Grace Energy Corp.** | Dallas |
| 291 | **Great Eastern Energy & Development Corp.** | Englewood, Colo. |
| 392 | **Great Northern Gas Co.** | Denver |
| 238 | **Greenwood Holdings Inc.** | Englewood, Colo. |
| 251 | **Gulf Exploration Consultants Inc.** | Houston |
| 239 | **Habersham Energy Co.** | Atlanta |
| 59 | **Hadson Corp.** | Oklahoma City |
| 364 | **Halley Energy Corp.** | Abilene, Tex. |
| 199 | **Hallador Petroleum Co.** | Denver |
| 112 | **Hallwood Energy Corp.** | Dallas |
| 117 | **Hallwood Energy Partners, L.P.** | Dallas |
| 53 | **Hamilton Oil Corp.** | Denver |
| 235 | **HarCor Energy Inc.** | Beverly Hills, Calif. |

# The OGJ400 Company Index continued

| Rank by total assets | Company name | Headquarters city |
|---|---|---|
| 78 | Harken Energy Corp. | Bedford, Tex. |
| 284 | Hawks Industries Inc. | Casper, Wyo. |
| 57 | Helmerich & Payne, Inc. | Tulsa |
| 185 | Hershey Oil Corp. | Pasadena, Calif. |
| 399 | Hipoint Investments, Ltd. | Norman, Okla. |
| 229 | Home-Stake Oil & Gas Co. | Tulsa |
| 213 | Home-Stake Royalty Corp. | Tulsa |
| 274 | Houston Oil Royalty Trust | Houston |
| 92 | Howell Corp. | Houston |
| 352 | Hughes Texas Petroleum Corp. | Hattiesburg, Miss. |
| 346 | Imperial Petroleum Inc. | Dallas |
| 107 | Integrated Drilling and Exploration Inc. | Tulsa |
| 283 | International Basic Resources, Inc. | Spokane, Wash. |
| 393 | International Management & Research Corp. | Philadelphia |
| 317 | Intramerican Oil & Minerals Inc. | Dallas |
| 143 | KCS Group Inc. | Edison, N.J. |
| 159 | Kelley Oil Corp. | Houston |
| 109 | Kelley Oil & Gas Partners, Ltd. | Houston |
| 24 | Kerr-McGee Corp. | Oklahoma City |
| 111 | Key Production Co. Inc. | Denver |
| 300 | Kimco Energy Corp. | Denver |
| 207 | K.R.M. Petroleum Corp. | Stamford, Conn. |
| 194 | LL & E Royalty Trust | Houston |
| 244 | Lomak Petroleum Inc. | Fort Worth |
| 41 | Louisiana Land & Exploration Co. | New Orleans |
| 389 | Lynx Exploration Co. | Denver |
| 258 | Magic Circle Energy Corp. | Oklahoma City |
| 37 | Maxus Energy Corp. | Dallas |
| 150 | Maynard Oil Co. | Dallas |
| 145 | McFarland Energy Inc. | Santa Fe Springs, Calif. |
| 27 | Mesa L.P. | Amarillo |
| 396 | Mexco Energy Corp. | Midland |
| 376 | Minex Resources Inc. | Riverton, Wyo. |
| 149 | Mission Resource Partners, L.P. | Alameda, Calif. |
| 30 | Mitchell Energy & Development Corp. | The Woodlands, Tex. |
| 2 | Mobil Corp. | New York |
| 314 | Monogram Oil & Gas Inc. | North Canton, Ohio |
| 32 | Montana Power Co. | Butte, Mont. |
| 387 | Morrison Nuclear Inc. | Calgary, Alta., Can. |
| 334 | Mountain States Resources Corp. | Salt Lake City |
| 167 | MSR Exploration Ltd. | Cut Bank, Mont. |
| 31 | Murphy Oil Corp. | El Dorado, Ark. |
| 263 | Mustang Companies, Inc. | Great Bend, Kan. |
| 208 | Nahama & Weagant Energy Co. | Bakersfield, Calif. |
| 71 | National Cooperative Refinery Association | McPherson, Kan. |
| 39 | National Fuel Gas Co. | New York |
| 391 | National Petroleum Corp. Limited | Dallas |
| 62 | NERCO Oil & Gas, Inc. | Portland, Ore. |
| 154 | New London Inc. | San Antonio |
| 29 | NICOR Inc. | Naperville, Ill. |
| [illegible] | Noble Affiliates, Inc. | Ardmore, Okla. |
| 84 | Noble Drilling Corp. | Houston |
| 80 | NOMECO Oil & Gas Co. | Jackson, Mich. |
| 79 | Norcen Energy Resources Ltd. (US Operations) | Calgary, Alberta Can. |
| 220 | Normandy Oil and Gas Co. Inc. | Fort Worth |
| 400 | North Star Petroleum Inc. | Salt Lake City |
| 344 | Nova Natural Resources Corp. | Denver |
| 152 | Nucorp, Inc. | Chicago |
| 256 | Nugget Oil Corp. | Bloomington, Minn. |
| 287 | NY Life Oil&Gas Producing Properties I-A,Ltd. | Houston |
| 316 | NY Life Oil&Gas Producing Properties I-B,Ltd. | Houston |
| 259 | NY Life Oil&Gas Producing Properties I-C,Ltd. | Houston |
| 289 | NY Life Oil&Gas Producing Properties I-D,Ltd. | Houston |
| 247 | NY Life Oil&Gas Producing Properties II-A,L.P. | Houston |
| 249 | NY Life Oil&Gas Producing Properties II-B,L.P. | Houston |
| 297 | NY Life Oil&Gas Producing Properties II-C,L.P. | Houston |
| 209 | NY Life Oil&Gas Producing Properties II-D,L.P. | Houston |
| 218 | NY Life Oil&Gas Producing Properties II-E,L.P. | Houston |
| 265 | NY Life Oil&Gas Producing Properties II-F,L.P. | Houston |
| 204 | NY Life Oil&Gas Producing Properties II-G,L.P. | Houston |
| 8 | Occidental Petroleum Corp. | Los Angeles |
| 47 | Ocean Drilling & Exploration Co. | New Orleans |
| 388 | Oil City Petroleum Inc. | Tulsa |
| 153 | OKC Limited Partnership | Dallas |
| 237 | Omni Exploration Inc. | Columbus, Ohio |
| 48 | ONEOK Inc. | Tulsa |
| 21 | Oryx Energy Co. | Dallas |
| 271 | Oxford Consolidated Inc. | Denver |
| 43 | Pacific Enterprises Oil & Gas Co. | Los Angeles |
| 330 | Paine Webber/Geodyne Energy Income L.P. I-A | Tulsa |
| 276 | Paine Webber/Geodyne Energy Income L.P. I-B | Tulsa |
| 304 | Paine Webber/Geodyne Energy Income L.P. I-C | Tulsa |
| 281 | Paine Webber/Geodyne Energy Income L.P. I-D | Tulsa |
| 175 | Paine Webber/Geodyne Energy Income L.P. I-E | Tulsa |
| 230 | Paine Webber/Geodyne Energy Income L.P. I-F | Tulsa |
| 160 | Paine Webber/Geodyne Energy Income L.P. II-A | Tulsa |
| 180 | Paine Webber/Geodyne Energy Income L.P. II-B | Tulsa |
| 219 | Paine Webber/Geodyne Energy Income L.P. II-C | Tulsa |
| 177 | Paine Webber/Geodyne Energy Income L.P. II-D | Tulsa |
| 191 | Paine Webber/Geodyne Energy Income L.P. II-E | Tulsa |
| 196 | Pan Petroleum MLP | Kansas City, Mo. |
| 240 | Panhandle Royalty Co. | Oklahoma City |
| 354 | Pantepec International, Inc. | Woodbridge, Conn. |
| 275 | Parallel Petroleum Corp. | Midland |
| 85 | Parker & Parsley Development Partners L.P. | Midland |
| 261 | Partners Oil Co. | Houston |
| 286 | Pascall Group Inc. | Melbourne, Fla. |
| 103 | Patrick Petroleum Co. | Jackson, Mich. |
| 76 | Pauley Petroleum, Inc. | Roswell, N.M. |
| 137 | Penn Virginia Resources Corp. (Oil and gas) | Duffield, Va. |
| 18 | Pennzoil Co. | Houston |
| 343 | Penn-Pacific Corp. | Tulsa |
| 228 | Permian Basin Royalty Trust | Fort Worth |
| 332 | Petrol Industries, Inc. | Shreveport |
| 165 | Petroleum Development Corp. | Bridgeport, W.Va. |
| 182 | Petroleum Investments, Ltd. | Oklahoma City |
| 232 | Petrominerals Corp. | Tustin, Calif. |
| 11 | Phillips Petroleum Co. | Bartlesville, Okla. |
| 148 | Phoenix Resource Companies, Inc. | Oklahoma City |
| 298 | Pioneer Oil & Gas | Midvale, Utah |
| 124 | Plains Petroleum Co. | Lakewood, Colo. |
| 119 | Plains Resources Inc. | Houston |
| 312 | Plano Petroleum Corp. | Plano, Tex. |
| 197 | Plexus Resources Corp. | Salt Lake City |
| 68 | Pogo Producing Co. | Houston |
| 243 | Premier Resources Ltd. | Denver |
| 53 | Presidio Oil Co. | Englewood, Colo. |
| 216 | Prima Energy Corp. | Denver |
| 115 | Production Operators Corp. | Houston |
| 136 | Prudential-Bache Energy Growth Fund, L.P. G-1 | Covington, La. |
| 260 | Prudential-Bache Energy Income Fund 1983P-1 | Covington, La. |
| 246 | Prudential-Bache Energy Income Fund 1983P-2 | Covington, La. |
| 236 | Prudential-Bache Energy Income Fund 1983P-3 | Covington, La. |
| 123 | Prudential-Bache Energy Income L.P. VP-22 | Covington, La. |
| 223 | Prudential-Bache Energy Income L.P. II P-4 | Covington, La. |
| 225 | Prudential-Bache Energy Income L.P. II P-5 | Covington, La. |
| 241 | Prudential-Bache Energy Income L.P. II P-6 | Covington, La. |
| 221 | Prudential-Bache Energy Income L.P. II P-7 | Covington, La. |
| 183 | Prudential-Bache Energy Income L.P. II P-8 | Covington, La. |
| 210 | Prudential-Bache Energy Income L.P. II P-9 | Covington, La. |
| 186 | Prudential-Bache Energy Income L.P. II P-10 | Covington, La. |
| 195 | Prudential-Bache Energy Income L.P. II P-11 | Covington, La. |
| 142 | Prudential-Bache Energy Income L.P. III P-12 | Covington, La. |
| 162 | Prudential-Bache Energy Income L.P. III P-13 | Covington, La. |
| 132 | Prudential-Bache Energy Income L.P. III P-14 | Covington, La. |
| 146 | Prudential-Bache Energy Income L.P. III P-15 | Covington, La. |
| 121 | Prudential-Bache Energy Income L.P. IV P-16 | Covington, La. |
| 118 | Prudential-Bache Energy Income L.P. IV P-17 | Covington, La. |
| 127 | Prudential-Bache Energy Income L.P. V P-18 | Covington, La. |
| 116 | Prudential-Bache Energy Income L.P. V P-19 | Covington, La. |
| 128 | Prudential-Bache Energy Income L.P. V P-20 | Covington, La. |
| 114 | Prudential-Bache Energy Income L.P. V P-21 | Covington, La. |
| 348 | Prudential-Bache Pension & Retirement L.P. PBR-1 | Covington, La. |
| 292 | Prudential-Bache Pension & Retirement L.P. PBR-2 | Covington, La. |
| 234 | Prudential-Bache Pension & Retirement L.P. PBR-3 | Covington, La. |
| 254 | Prudential-Bache Pension & Retirement L.P. PBR-4 | Covington, La. |
| 264 | Pyramid Oil Co. | Bakersfield, Calif. |
| 269 | Q E D Exploration, Inc. | Denver |
| 280 | Questa Oil & Gas Co. | Tulsa |
| 45 | Questar Corp. | Salt Lake City |
| 326 | Ratex Resources Inc. | Oklahoma City |
| 190 | Red Eagle Resources Corp. | Oklahoma City |
| 320 | Republic Waste Industries, Inc. | Oklahoma City |
| 358 | Reserve Exploration Co. | Tulsa |
| 252 | Reserve Petroleum Co. | Oklahoma City |
| 171 | Resource America Inc. | Akron, Ohio |
| 361 | Roberts Oil and Gas Inc. | Houston |
| 306 | Robson Petroleum Ltd. | Tulsa |
| 272 | Roxana Resources, Ltd. | Tulsa |
| 217 | Sabine Royalty Trust | Dallas |
| 268 | Sage Drilling Co. | Wichita, Kan. |
| 105 | Sage Energy Co. | San Antonio |
| 125 | Samson Energy Co. L.P. | Tulsa |
| 99 | San Juan Basin Royalty Trust | Fort Worth |
| 49 | Santa Fe Energy Resources, Inc. | Houston |

## OGJ400 Index continued

| Rank by total assets | Company name | Headquarters city |
|---|---|---|
| 75 | **Seagull Energy Corp.** | Houston |
| 336 | **Search Natural Resources, Inc.** | Dallas |
| 395 | **Senergy 1985 Ltd.** | Houston |
| 353 | **Senergy 1986 Ltd.** | Houston |
| 338 | **Sharon Energy Ltd.** | Englewood, Colo. |
| 327 | **Sheffield Exploration Co. Inc.** | Denver |
| 5 | **Shell Oil Co.** | Houston |
| 89 | **Snyder Oil Partners L.P.** | Fort Worth |
| 26 | **Sonat Inc.** | Birmingham, Ala. |
| 398 | **Sooner Energy Corp.** | Oklahoma City |
| 381 | **South Texas Drilling & Exploration, Inc.** | San Antonio |
| 266 | **Southern Mineral Corp.** | Houston |
| 73 | **Southern Union Co.** | Austin |
| 72 | **Southwestern Energy Co.** | Fayetteville, Ark. |
| 380 | **Standard Oil & Exploration of Delaware Inc.** | Sarasota, Fla. |
| 386 | **Stellar Petroleum Inc.** | Dallas |
| 231 | **Striker Petroleum Corp.** | Denver |
| 370 | **Struthers Oil & Gas Corp.** | Tulsa |
| 181 | **Sunlite Inc.** | Alpharetta, Ga. |
| 69 | **Sunshine Mining Co.** | Dallas |
| 102 | **Swift Energy Co.** | Houston |
| 309 | **Tatum Petroleum Corp.** | Yorb Linda, Calif. |
| 129 | **Taurus Exploration, Inc.** | Birmingham, Ala. |
| 368 | **Taurus Petroleum Inc.** | Denver |
| 67 | **Tesoro Petroleum Corp.** | San Antonio |
| 6 | **Texaco Inc.** | White Plains, N.Y. |
| 138 | **Texas Meridian Resources Ltd.** | Houston |
| 362 | **Texas Vanguard Oil Co.** | Austin |
| 83 | **TGX Corp.** | Shreveport |
| 120 | **Thermal Exploration** | Seattle |
| 203 | **Thor Energy Resources Inc.** | Tyler, Tex. |
| 242 | **Tide West Oil Co.** | Holdenville, Okla. |
| 178 | **Tipperary Corp.** | Midland |
| 113 | **Tom Brown Inc.** | Midland |
| 294 | **Toreador Royalty Corp.** | Dallas |
| 366 | **TPEX Exploration Inc.** | Denver |
| 277 | **Trinity Resources Ltd.** | Houston |
| 54 | **Triton Energy Corp.** | Dallas |
| 394 | **Triumph Oil & Gas Corp.** | New York |
| 359 | **Tri-Valley Corp.** | Bakersfield, Calif. |
| 198 | **Tucker Drilling Co. Inc.** | San Angelo, Tex. |
| 295 | **Tyrex Oil Co.** | Casper, Wyo. |
| 61 | **Unimar Co.** | Tarrytown, N.Y. |
| 35 | **Union Exploration Partners Ltd.** | Houston |
| 33 | **Union Pacific Resources Co.** | Fort Worth |
| 34 | **Union Texas Petroleum Holdings, Inc.** | Houston |
| 110 | **Unit Corp.** | Tulsa |
| 270 | **United Trans-Western, Inc.** | Dallas |
| 13 | **Unocal Corp.** | Los Angeles |
| 10 | **USX (Oil & Gas segment)** | Pittsburgh |
| 214 | **Vermilion Bay Land Co.** | Lafayette, La. |
| 303 | **Vineyard Oil & Gas Co.** | Northeast, Pa. |
| 86 | **Wainoco Oil Corp.** | Houston |
| 372 | **Western Energy Resources Inc.** | Laguna Niguel, Calif. |
| 273 | **WEXCO of Delaware, Inc.** | Milwaukee, Wis. |
| 215 | **Whiting Petroleum Corp.** | Denver |
| 172 | **Wichita River Oil Corp.** | Denver |
| 345 | **Willard Pease Oil & Gas Co.** | Grand Junction, Colo. |
| 139 | **Wilshire Oil Co. of Texas** | Jersey City, N.J. |
| 95 | **Wiser Oil Co.** | Sistersville, W.Va. |
| 104 | **Wolverine Exploration Co.** | Fort Worth |
| 279 | **Woodbine Petroleum Inc.** | Dallas |
| 385 | **Wyoming Oil & Minerals, Inc.** | Casper, Wyo. |
| 390 | **Yellowstone Resources, Inc.** | Denver |
| 233 | **Z G Energy Corp.** | Tulsa |
| 55 | **Zapata Corp.** | Houston |

# CRUDE OIL ASSAYS

### Key to the assays . . .

Each assay is headed, in the following order, by the official name of the crude, the former or secondary name in parenthesis, the country of origin, and location and type loading facilities. Loading systems that frequently crop up are abbreviated. Those used are CBM (conventional buoy mooring), SPM (single point mooring), SBM (single buoy mooring), CALM (catenary anchor leg mooring), and SALM (single anchor leg mooring).

# Mideast

## Aboozar (Ardeshir), Iran

*Terminal Kharg Island*

**Crude**
Gravity, °API: 26.9
Sulfur, wt %: 2.48
Rvp, psi: 5.5
$H_2S$ (dissolved) wt %: 0.031
$H_2S$ (evolved) wt %: 0.089
Pour pt, °F.: −30
Salt, lb/1,000 bbl: 55.0
Neutralization value, mg KOH/g: 1.96
Rams. carbon, wt %: 5.9
Kin. vis., cSt @ 68° F.: 36.58
@ 122° F.: 12.76
V/Ni, ppm: 71/21
Light hydrocarbons, vol %: 3.86

**Naphtha**
Range (TBP), °F.: $C_5$-200
Yield, vol %: 5.5
Gravity, °API: 80.2
Sulfur (total) wt %: 0.090
Mercaptan S, wt %: 0.044
Rvp, psi: 10.3
Paraffins, vol %: 72.6
Naphthenes, vol %: 24.2
Aromatics, vol %: 3.1
RON, clear: 71.7
MON, clear: 67.9

**Naphtha**
Range (TBP), °F.: 200-320
Yield, vol %: 8.4
Gravity, °API: 55.7
Sulfur (total) wt %: 0.097
Mercaptan S, wt %: 0.027
Rvp, psi: 1.0
P/N/A, vol %: 60.1/27.3/12.7
RON, clear: 45.7
MON, clear: 44.3

**Naphtha**
Range (TBP), °F.: 320-360
Yield, vol %: 3.8
Gravity, °API: 48.6
Sulfur (total), wt %: 0.158
Mercaptan S, wt %: 0.023
P/N/A, vol %: 59.1/25.8/15.1
RON, clear: 30.2
MON, clear: 31.4

**Kerosine**
Range (TBP), °F.: 360-520
Yield, vol %: 14.4
Gravity, °API: 41.9
Sulfur (total), wt %: 0.452
Mercaptan S, wt %: 0.015
Aniline pt, °F.: 143.9
Diesel index: 60.2
Cetane index: 49.3
Freeze pt, °F.: −32
Cloud pt, °F.: −49
Pour pt, °F.: −52
Smoke pt, mm: 20

**Gas oil**
Range (TBP), °F.: 520-650
Yield, vol %: 12.7
Gravity, °API: 33.4
Sulfur (total), wt %: 1.274
Charac. factor: 11.74
Aniline pt, °F.: 158.8
Diesel index: 53.0
Cetane index: 52.7
Cloud pt, °F.: 21
Pour pt, °F.: 18
Vis., SUS @ 100° F.: 40.4
@ 122° F.: 37.1

**Residuum**
Range (TBP), °F.: 650+
Yield, vol %: 53.5
Gravity, °API: 12.5
Sulfur (total), wt %: 3.804
Pour pt, °F.: 56
Rams. carbon, wt %: 10.0
Vis., SUS @ 122° F.: 12,303.9
@ 210° F.: 465.9
V/Ni, ppm: 120/36

**Residuum**
Range (TBP), °F.: 1,050+
Yield, vol %: 24.2
Gravity, °API: 3.5
Sulfur (total), wt %: 5.069
Pour pt, °F.: 210
Rams. carbon, wt %: 19.6
Vis., SUS @ 210° F.: 125,012.7
V/Ni, ppm: 244/74

## Abu Al Bu Khoosh, Abu Dhabi, U.A.E.

*Storage tanker offshore producing area*

**Crude**
Gravity, °API: 31.6
Sulfur, wt %: 2.0
Pour pt, °C.: −12 (−24.5° F.)
Kin. vis., 37.8° C. cSt: 6.7
Con. carbon, wt %: 4.3
Rvp, psi: 3.5
V/Ni, ppm: 12/7
Ibp-15° C. yield, wt %: 0.59
vol %: 0.69

**Light naphtha**
Range, °C.: 15-65
Yield, wt %: 2.74
vol %: 3.59
Gravity, °API: 88.7
Sulfur, wt %: 0.03
Mercaptans, ppm: 325
Paraffins, vol %: 95
Naphthenes, vol %: 4.4
Aromatics, vol %: 0.06
RON, clear: 74
RON + 3 ml TEL: 94.5

**Heavy naphtha**
Range, °C.: 65-165
Yield, wt %: 14.45
vol %: 16.83
Gravity, °API: 59.6
Sulfur, wt %: 0.05
Mercaptans, ppm: 276
P/N/A, vol %: 68.3/18.5/13.2

**Kerosine**
Range, °C.: 165-230
Yield, wt %: 11.52
vol %: 12.53
Gravity, °API: 46.25
Sulfur, wt %: 0.16
Mercaptans, ppm: 182
P/N/A, vol %: 55.5/21.8/22.7
Freezing pt, °C.: −52.5
Aniline pt, °C.: 56.4
Diesel index: 61.7
Smoke pt, mm: 23

**Light gas oil**
Range, °C.: 230-300
Yield, wt %: 12.5
vol %: 12.96
Gravity, °API: 37.6
Sulfur, wt %: 0.85
Pour pt, °C.: −27
Cloud pt, °C.: −19
Aniline pt, °C.: 65
Diesel index: 55.9
Kin. vis., cSt @ 37.8° C.: 2.63

**Heavy gas oil**
Range, °C.: 300-375
Yield, wt %: 13.83
vol %: 12.71
Gravity, °API: 30.3
Sulfur, wt %: 1.9
Pour pt, °C.: +2
Cloud pt, °C.: +7
Aniline pt, °C.: 72.2
Diesel index: 49.1
Kin. vis., cSt @ 37.8° C.: 6.92

**Distillate**
Range, °C.: 375-550
Yield, wt %: 26.63
vol %: 24.95
Gravity, °API: 21.4

Sulfur, wt %: 2.57
Pour pt, °C.: +26
Cloud pt, °C.: +28
Con. carbon, wt %: 6.7
Kin. vis., cSt @ 50° C.: 40.96
@ 98.9° C.: 7.89

**Residue**
Range, °C.: 375+
Yield, wt %: 45.37
vol %: 40.69
Gravity, °API: 14.9
Sulfur, wt %: 3.4
Pour pt, °C.: +21
Asphaltenes, wt %: 3.1
V/Ni, ppm: 30/14
Kin. vis., cSt @ 50° C.: 435
@ 98.9° C.: 40.3

**Residue**
Range, °C.: 550+
Yield, wt %: 18.7
vol %: 15.7
Gravity, °API: 4.3
Sulfur, wt %: 4.4
Pour pt, °C.: +50
Asphaltenes, wt %: 9.2
V/Ni, ppm: 67/35
Kin. vis., cSt @ 98.9° C.: 1.860
Pen. at 25° C.: 125

## Arabian Heavy (Safaniya), Saudi Arabia

*Ras Tanura*

**Crude**
Gravity, °API: 27.9
Sulfur, wt %: 2.85
Pour pt, °F.: −20
Rvp, psi: 7.5
Kin. vis., cSt @ 70° F.: 37.0
@ 100° F.: 19.0

**Light naphtha**
Range, °FVT: 68-212
Yield, vol %: 7.9
Gravity, °API: 79.9
Sulfur, wt %: 0.0059
Rvp, psi: 8.5
Paraffins, vol %: 88.6
Naphthenes, vol %: 10.2
Aromatics, vol %: 1.2
RON, clear: 58.0

**Heavy naphtha**
Range, °FVT: 212-302
Yield, vol %: 6.8
Gravity, °API: 60.5
Sulfur, wt %: 0.016
P/N/A, vol %: 70.8/19.5/9.7

**Kerosine**
Range, °FVT: 302-455
Yield, vol %: 12.4
Gravity, °API: 48.4
Sulfur, wt % 0.16
Aromatics, vol %: 18.9
Freeze pt °F.: −67
Smoke pt, mm: 26
Luminometer no.: 57
Aniline pt, °F.: 141
Kin. vis., cSt @ −30° F.: 5.14
@ 100° F.: 1.14

**Light gas oil**
Range, °FVT: 455-650
Yield, vol %: 16.5
Gravity, °API: 35.2
Sulfur, wt %: 1.30
Pour pt, °F.: 5
Aniline pt, °F.: 154
Kin. vis., cSt @ 100° F.: 3.45
@ 210° F.: 1.30

**Heavy gas oil**
Range, °FVT: 650-1,049
Yield, vol %: 30.6
Gravity, °API: 20.9
Sulfur, wt %: 2.92
Pour pt, °F.: 95
Aniline pt, °F.: 173
Kin. vis., cSt @ 100° F.: 77.0
@ 210° F.: 8.46

**Residual oil**
Range, °FVT: 650+
Yield, vol %: 53.8
Gravity, °API: 12.6
Sulfur, wt %: 4.34
Pour pt, °F.: 60
Con. carbon, wt %: 13.3
Kin. vis., cSt @ 100° F.: 4,103
@ 210° F.: 94.2

**Residual oil**
Range, °FVT: 1,049+
Yield, vol %: 23.2
Gravity, °API: 3.0
Sulfur, wt %: 6.0
Pour pt, °F.: 120+
Con. carbon, wt %: 27.7
Kin. vis., cSt @ 210° F.: 55,292
Furol, sec @ 275° F.: 1,309
V/Ni/Fe, ppm: 205/64/30

## Arabian Light, Saudi Arabia

*Ras Tanura and Yanbu also Sidon, Lebanon*

**Crude**
Gravity, °API: 33.4
Sulfur, wt %: 1.79
Pour pt, °F.: −30
Rvp, psi: 3.6
Kin. vis., cSt @ 70° F.: 10.2
@ 100° F.: 6.25

**Light naphtha**
Range, °FVT: 68-212
Yield, vol %: 8.9
Gravity, °API: 78.4
Sulfur, wt %: 0.024
Rvp, psi: 8.2
Paraffins, vol %: 86.8
Naphthenes, vol %: 10.7
Aromatics, vol %: 2.5
RON, clear: 55.0

**Heavy naphtha**
Range, °FVT: 212-302
Yield, vol %: 8.5
Gravity, °API: 59.3
Sulfur, wt %: 0.027
P/N/A, vol %: 68.3/19.0/12.7

**Kerosine**
Range, °FVT: 302-455
Yield, vol %: 16.5
Gravity, °API: 48.0
Sulfur, wt %: 0.084
Aromatics, vol %: 20.6
Freeze pt, °F.: −71
Smoke pt, mm: 23
Luminometer no.: 51
Aniline pt, °F.: 138
Kin. vis., cSt @ −30° F.: 5.39
@ 100° F.: 1.13

**Light gas oil**
Range, °FVT: 455-650
Yield, vol %: 19.7
Gravity, °API: 36.5
Sulfur, wt %: 1.03
Pour pt, °F.: 5
Aniline pt, °F.: 158
Kin. vis., cSt @ 100° F.: 3.35
@ 210° F.: 1.30

**Heavy gas oil**
Range, °FVT: 650-1,049
Yield, vol %: 29.8
Gravity, °API: 22.9
Sulfur, wt %: 2.41
Pour pt, °F.: 95
Aniline pt, °F.: 180
Kin. vis., cSt @ 100° F.: 55.5
@ 210° F.: 6.89

**Residual oil**
Range, °FVT: 650+
Yield, vol %: 44.6
Gravity, °API: 17.2
Sulfur, wt %: 3.1
Pour pt, °F.: 35
Con. carbon, wt %: 7.6
Kin. vis., cSt @ 100° F.: 414.3
@ 210° F.: 24.2

**Residual oil**
Range, °FVT: 1,049+
Yield, vol %: 14.8
Gravity, °API: 6.9
Sulfur, wt %: 4.34
Pour pt, °F.: 115
Con. carbon, wt %: 20.3
Kin. vis., cSt @ 210° F.: 1,589
Furol, sec @ 275° F.: 104
V/Ni/Fe, ppm: 116/25/114

## Arabian Light (Berri), Saudi Arabia

*Ras Tanura*

**Crude**
Gravity, °API: 37.8
Sulfur, wt %: 1.19
Pour pt, °F.: −25
Rvp, psi: 4.0
Kin. vis., cSt @ 70° F.: 5.80
@ 100° F.: 3.86

**Light Naphtha**
Range, °FVT: 68-212
Yield, vol %: 10.1
Gravity, °API: 78.4
Sulfur, wt %: 0.071
Rvp, psi: 6.9
Paraffins, vol %: 87.4
Naphthenes, vol %: 11.2
Aromatics, vol %: 1.4
RON, clear: 50.0

**Heavy naphtha**
Range, °FVT: 212-302
Yield, vol %: 8.7
Gravity, °API: 58.2
Sulfur, wt %: 0.053
P/N/A, vol %: 65.3/20.4/14.3

**Kerosine**
Range, °FVT: 302-455
Yield, vol %: 18.7
Gravity, °API: 48.4
Sulfur, wt %: 0.090
Aromatics, vol %: 19.9
Freeze pt, °F.: −71
Smoke pt, mm: 25
Luminometer no.: 54
Aniline pt, °F.: 136
Kin. vis., cSt @ −30° F.: 4.79
@ 100° F.: 1.10

**Light gas oil**
Range, °FVT: 455-650
Yield, vol %: 21.2
Gravity, °API: 37.3
Sulfur, wt %: 0.72
Pour pt, °F.: 10
Aniline pt, °F.: 161
Kin. vis., cSt @ 100° F.: 3.4
@ 210° F.: 1.28

**Heavy gas oil**
Range, °FVT: 650-1,049
Yield, vol %: 30.3
Gravity, °API: 25.1
Sulfur, wt %: 1.83
Pour pt, °F.: 95
Aniline pt, °F.: 192
Kin. vis., cSt @ 100° F.: 44.4
@ 210° F.: 6.25

**Residual oil**
Range, °FVT: 650+
Yield, vol %: 39.3
Gravity, °API: 21.6
Sulfur, wt %: 2.09
Pour pt, °F.: 70
Con. carbon, wt %: 4.2
Kin. vis., cSt @ 100° F.: 128.1
@ 210° F.: 12.34

**Residual oil**
Range, °FVT: 1,049+
Yield, vol %: 9.0
Gravity, °API: 11.0
Sulfur, wt %: 2.88
Pour pt, °F.: 80
Con. carbon, wt %: 16.2
Kin. vis., cSt @ 210° F.: 396.9
Furol, sec @ 275° F.: 38.2
V/Ni, ppm: 9/6
Aromatics, ppm: 46

## Arabian Medium (Khursaniyah), Saudi Arabia

### *Ras Tanura*

**Crude**
Gravity, °API: 30.8
Sulfur, wt %: 2.40
Pour pt, °F.: +5
Rvp, psi: 3.2
Kin. vis., cSt @ 70° F.: 16.2
@ 100° F.: 9.41

**Light naphtha**
Range, °FVT: 68-212
Yield, vol %: 8.9
Gravity, °API: 77.7
Sulfur, wt %: 0.043
Rvp, psi: 7.9
Paraffins, vol %: 85.3
Naphthenes, vol %: 12.3
Aromatics, vol %: 2.4
RON, clear: 54.5

**Heavy naphtha**
Range, °FVT: 212-302
Yield, vol %: 7.7
Gravity, °API: 59.1
Sulfur, wt %: 0.050
P/N/A, vol %: 68.5/18.8/12.7

**Kerosine**
Range, °FVT: 302-455
Yield, vol %: 14.5
Gravity, °API: 48.0
Sulfur, wt %: 0.14
Aromatics, vol %: 20.6
Freeze pt, °F.: -62
Smoke pt, mm: 23
Luminometer no.: 52
Aniline pt, °F.: 136
Kin. vis., cSt @ -30° F.: 5.10
@ 100° F.: 1.13

**Light gas oil**
Range, °FVT: 455-650
Yield, vol %: 18.1
Gravity, °API: 36.0
Sulfur, wt %: 1.24
Pour pt, °F.: 15
Aniline pt, °F.: 157
Kin. vis., cSt @ 100° F.: 3.53
@ 210° F.: 1.32

**Heavy gas oil**
Range, °FVT: 650-1,049
Yield, vol %: 30.9
Gravity, °API: 21.9
Sulfur, wt %: 2.91
Pour pt, °F.: 100
Aniline pt, °F.: 176
Kin. vis., cSt @ 100° F.: 49.2
@ 210° F.: 6.40

**Residual oil**
Range, °FVT: 650+
Yield, vol %: 49.6
Gravity, °API: 15.0
Sulfur, wt %: 3.90
Pour pt, °F.: 55
Con. carbon, wt %: 9.9
Kin. vis., cSt @ 100° F.: 850
@ 210° F.: 36.0

**Residual oil**
Range, °FVT: 1,049+
Yield, vol %: 18.7
Gravity, °API: 4.9
Sulfur, wt %: 5.35
Pour pt, ° F.: 115
Con. carbon, wt %: 23.3
Kin. vis., cSt @ 210° F.: 3,847
Furol, sec @ 275° F.: 226
V/Ni/Fe, ppm: 96/32/30

## Arabian Medium (Zuluf/Marjan), Saudi Arabia

### *Juayma*

**Crude**
Gravity, °API: 31.1
Sulfur, wt %: 2.48
Pour pt, °F.: -20
Rvp, psi: 8.3
Kin. vis., cSt @ 70° F.: 19.4
@ 100° F.: 11.01

**Light naphtha**
Range, °FVT: 68-212
Yield, vol %: 8.9
Gravity, °API: 79.7
Sulfur, wt %: 0.0069
Rvp, psi: 9.1
Paraffins, vol %: 89.3
Naphthenes, vol %: 9.6
Aromatics, vol %: 1.1
RON, clear: 58.6

**Heavy naphtha**
Range, °FVT: 212-302
Yield, vol % on crude: 8.2
Gravity, °API: 60.2
Sulfur, wt %: 0.024
P/N/A, vol %: 69.3/20.2/10.5

**Kerosine**
Range, °FVT: 302-455
Yield, vol %: 14.1
Gravity, °API: 48.3
Sulfur, wt %: 0.14
Aromatics, vol %: 17.2
Freeze pt, °F.: -72
Smoke pt, mm: 26
Luminometer no.: 59
Aniline pt, °F.: 139
Kin. vis., cSt @ -30° F.: 5.01
@ 100° F.: 1.13

**Light gas oil**
Range, °FVT: 455-650
Yield, vol %: 17.6
Gravity, °API: 36.1
Sulfur, wt %: 1.25
Pour pt, °F.: 10
Aniline pt, °F.: 158
Kin. vis., cSt @ 100° F.: 3.45
@ 210° F.: 1.31

**Heavy gas oil**
Range, °FVT: 650-1,049
Yield, vol %: 28.2
Gravity, °API: 21.8
Sulfur, wt %: 2.90
Pour pt, °F: 95
Aniline pt, °F.: 177
Kin. vis., cSt @ 100° F.: 72.6
@ 210° F.: 8.04

**Residual oil**
Range, °FVT: 650+
Yield, vol %: 48.0
Gravity, °API: 13.9
Sulfur, wt %: 4.06
Pour pt, ° F.: 55
Con. carbon, wt %: 9.4
Kin. vis., cSt @ 100° F.: 2,126
@ 210° F.: 5.9

**Residual oil**
Range, °FVT: 1,049+
Yield, vol %: 19.8
Gravity, °API: 3.9
Sulfur, wt %: 5.51
Pour pt, ° F.: 140
Con. carbon, wt %: 20.5
Kin. vis., cSt @ 210° F.: 20,085
Furol, sec @ 275° F.: 684
V/Ni/Fe, ppm: 179/54/40

## Bahrgansar/Nowruz (SIRIP Blend), Iran

### *Ras Bahrgan SBM*

**Crude**
Gravity, °API: 27.1
Sulfur, wt %: 2.45
Pour pt, °C.: -33
Vis., cSt @ 100° F.: 20.4
Con. carbon, wt %: 7.9
Rvp, kg/sq cm: 0.56
Salt, lb/1,000 bbl: 30.6
V/Ni, ppm: 72/25

**Light naphtha**
Range, °C.: $C_5$-66
Yield, wt %: 3.76
Gravity, °API: 84.3
Sulfur, wt %: 0.065
Rvp, kg/sq cm: 0.87
Paraffins, vol %: 92.3
Naphthenes, vol %: 6.3
Aromatics, vol %: 1.4
RON, clear: 67.4

**Heavy naphtha**
Range, °C.: 66-150
Yield, wt %: 8.59
Gravity, °API: 59.6
Sulfur, wt %: 0.06
P/N/A, vol %: 60.0/31.0/9.0
RON, clear: 48.0

**Kerosine**
Range, °C.: 150-250
Yield, wt %: 13.23
Gravity, °API: 46.0
Sulfur, wt %: 0.228
Aromatics, vol %: 18.5
Freezing pt, °C.: < -55
Smoke pt, mm: 22
Aniline pt, °C.: 59.8

**Gas oil**
Range, °C.: 250-350
Yield, wt %: 14.04
Gravity, °API: 33.6
Sulfur, wt %: 1.19
Pour pt, °C.: -12
Aniline pt, °C.: 69.2
Diesel index: 53.0

**Residual oil**
Range, °C.: 350+
Yield, wt %: 59.00
Gravity, °API: 11.3
Sulfur, wt %: 3.8
Pour pt, °C.: +12
Con. carbon, wt %: 13.35

**Residual oil**
Range, °C.: 550+
Yield, wt %: 35.90
Gravity, °API: 4.4
Sulfur, wt %: 4.84
Pour pt, °C.: >+48
Con. carbon, wt %: 21.85
V/Ni/Fe, ppm: 202/69/52

Note: Same assay first published in 1976.

## Basrah Heavy, Iraq

*Mina al Bakr sea terminal in Persian Gulf (Khor al Khafja)*

**Crude**
Gravity, °API: 24.7
Sulfur, wt %: 3.5
Pour pt, °C.: −30
Kin. vis. @ 10° C., cSt: 86.3
$C_4$ & lighter, wt %: 0.8

**Light SR naphtha**
Range, °C.: $C_5$-65
Yield, wt %: 2.6
Density @ 15° C., g/cu m: 0.648
RON + 0.4 g Pb/l: 83

**Heavy SR naphtha**
Range, °C.: 65-175
Yield, wt %: 12.2
Density @ 15° C., g/cu m: 0.74
RON + 0.4 g Pb/l: 55
Aromatics, vol %: 9.5
Naphthenes, vol %: 21

**Kerosine**
Range, °C.: 175-222
Yield, wt %: 6.9
Density @ 15° C., g/cu m: 0.799
Sulfur, wt %: 0.38

**Gas oil**
Range, °C.: 225-360
Yield, wt %: 21.6
Density @ 15° C., g/cu m: 0.871
Sulfur, wt %: 1.95
Pour pt, °C.: −16
Cold filter pour pt, °C.: −14
Kin. vis., cSt @ 100° C.: 1.42

**Heavy gas oil**
Range, °C.: 360-460
Yield, wt %: 13.5
Density @ 15° C., g/cu m: 0.935
Sulfur, wt %: 3.57
Kin. vis., cSt @ 100° C.: 5.20

**Long residuum**
Range, °C.: 360+
Yield, wt %: 55.9
Density @ 15° C., g/cu m: 1.012
Sulfur, wt %: 5.25
Kin. vis., cSt @ 100° C.: 178.2

**Short residuum**
Range, °C.: 460+
Yield, wt %: 42.4
Density @ 15° C., g/cu m: 1.041
Sulfur, wt %: 5.80
Kin. vis., cSt @ 100° C.: 1,350
Con. carbon, wt %: 22.0
V/Ni, ppm: 212/26
Pen. @ 25° C., 0.1 mm: 180

## Basrah Light, Iraq

*Marine pipeline to Khor-al-Amaya piled structure in gulf*

**Crude**
Gravity, °API: 33.7
Sulfur, wt %: 1.95
Pour pt, °C.: −15
Kin. vis., cSt @ 10° C.: 15.0
$C_4$ & lighter, wt %: 1.3

**Light SR naphtha**
Range, °C.: $C_5$-65
Yield, wt %: 3.7
Density @ 15° C., g/cu m: 0.646
RON + 0.4 g Pb/l: 83

**Heavy SR naphtha**
Range, °C.: 65-175
Yield, wt %: 16.2
Density @ 15° C., g/cu m: 0.737
RON + 0.4 g Pb/l: 54
Aromatics, vol %: 10
Naphthenes, vol %: 17

**Kerosine**
Range, °C.: 175-225
Yield, wt %: 8.2
Density @ 15° C., g/cu m: 0.795
Sulfur, wt %: 0.10

**Gas oil**
Range, °C.: 225-360
Yield, wt %: 22.9
Density @ 15° C., g/ cu m: 0.843
Sulfur, wt %: 1.20
Pour pt, °C.: −12
CFPP, °C.: −9
Kin. vis., cSt @ 100° C.: 1.35

**Heavy gas oil**
Range, °C.: 360-525
Yield, wt %: 25.1
Density @ 15° C., g/cu m: 0.916
Sulfur, wt %: 2.41
Kin. vis., cSt @ 100° C.: 8.00

**Long residuum**
Range, °C.: 360+
Yield, wt %: 47.7
Density @ 15° C., g/cu m: 0.966
Sulfur, wt %: 3.60
Kin. vis., cSt @ 100° C.: 38.5

**Short residuum**
Range, °C.: 525+
Yield, wt %: 22.6
Density @ 15 °C., g/cu m: 1.020
Sulfur, wt %: 4.70
Kin. vis., cSt @ 100 °C.: 760
Con. carbon, wt %: 18.5
V/Ni, ppm: 80/22

## Basrah Medium, Iraq

*Mina-al-Bakr sea terminal in Persian Gulf (Khor al Khafja)*

**Crude**
Gravity, °API: 31.1
Sulfur, wt %: 2.58
Pour pt, °C.: −30
Kin. vis., cSt @ 10° C.: 41.0
$C_4$ & lighter, wt %: 1.6

**Light SR naphtha**
Range, °C.: $C_5$-65
Yield, wt %: 3.3
Density, 15° C., g/cu m: 0.64
RON + 0.4, g Pb/l: 80

**Heavy SR naphtha**
Range, °C.: 65-175
Yield, wt %: 14.9
Density @ 15° C., g/cu m: 0.736
RON + 0.4 g Pb/l: 54
Aromatics, vol %: 10.0
Naphthenes, vol %: 17

**Kerosine**
Range, °C.: 175-225
Yield, wt %: 7.5
Density @ 15° C., g/cu m: 0.793
Sulfur, wt %: 0.23

**Gas oil**
Range, °C.: 225-360
Yield, wt %: 22.3
Density @ 15° C., g/cu m: 0.849
Sulfur, wt %: 1.57
Pour pt, °C.: −13
CFPP, °C.: −10
Kin. vis., cSt @ 100° C.: 1.44

**Heavy gas oil**
Range, °C.: 360-520
Yield, wt %: 21.9
Density @ 15° C., g/cu m: 0.931
Sulfur, wt %: 3.08
Kin. vis., cSt @ 100 ° C.: 8.74

**Long residuum**
Range, °C.: 360+
Yield, wt %: 50.4
Density @ 15° C., g/cu m: 0.984
Sulfur, wt %: 4.38
Kin. vis., cSt @ 100° C.: 61.7

**Short residuum**
Range, °C.: 520+
Yield, wt %: 28.5
Density @ 15° C., g/cu m: 1.032
Sulfur, wt %: 5.43
Kin. vis., cSt @ 100° C.: 1,400
Con. carbon, wt %: 19.0
V/Ni, ppm: 175/63
Pen. @ 25° C., 0.1 mm: 180

## Belayim, Egypt

*Wadi el Feiran, Gulf of Suez*

**Crude**
Gravity, °API: 27.5
Sulfur, wt %: 2.20
Vis., cSt @ 20° C.: 51.27
Pour pt, °C.: +6
Wax content, wt %: 8.0
Rvp, psi: 6.50
Carbon residue, wt %: 7.25
V/Ni, ppm: 79.4/54.6
$C_1$-$C_4$, yield, vol %: 2.43

**Naphtha**
Range, °C.: $C_5$-82
Yield, vol %: 5.12
RON, clear: 67.0
Ron + 0.4 Pb/l: 80.[illegible]

**Naphtha**
Range, °C.: 82-160
Yield, vol %: 10.15
Paraffins, vol %: 57.0
Napthenes, vol %: 33.0
Aromatics, vol %: 10.0
RON, clear: 47.2

**Kerosine**
Range, °C.: 160-230
Yield, vol %; 9.36
Gravity, °API: 45.4
Total sulfur, wt %: 0.36
Smoke pt, mm: 24
Aromatics, vol %: 16.7

**Gas oil**
Range, °C.: 230-350
Yield, vol %: 18.49
Gravity, °API: 34.0
Total sulfur, wt %: 1.47
Vis., cSt @ 20° C.: 6.532
Pour pt, °C: −7
Aniline pt, °C.: 69.2
Diesel index: 53.2

**Vacuum distillate**
Range, °C.: 350-550
Yield, vol %: 26.94
Gravity, °API: 23.2
Total sulfur, wt %: 2.19
Vis., cSt @ 50° C.: 36.24
Pour pt, °C.: +39
Carbon residue, wt %: 0.65
Basic N, ppm: 540
Total N, ppm: 1,813

**Residue**
Range, °C.: 350+
Yield, vol %: 54.45
Gravity, °API: 13.5
Total sulfur, wt %: 3.12
Vis., cSt @ 50° C.: 1,508
Pour pt, °C.: +30
Wax content, wt %: 13.7
Carbon residue, wt %: 12.10
V/Ni, ppm: 133.1/91.5

## Burgan (Wafra), Divided Zone

*Mina Saud, Divided Zone CBM, also Mina Abdulla, Kuwait*

**Crude**
Gravity, °API: 23.3
Sulfur, wt %: 3.37
Pour pt, °F.: −5
Vis., Saybolt @ 122° F.: 134
Con. carbon, wt %: 7.7
Rvp, psi: 3.4
Salt content, lb/1,000 bbl: 17.5
V/Ni, ppm: 34/6.8

**Light naphtha**
Range, °F.: IBP-200
Yield, vol %: 3.20
Gravity, °API: 77.5
Sulfur, wt %: 0.01
Rvp, psi: 9.6
Paraffins, vol %: 74
Naphthenes, vol %: 25
Aromatics, vol %: 1
RON, clear: 73.1

**Heavy naphtha**
Range, °F.: 200-435
Yield, vol %: 13.62
Gravity, °API: 49.8
Sulfur, wt %: 0.15
Rvp, psi: 0.2
P/N/A, vol %: 44/36/20
RON, clear: 52.0
RON, + 3 g TEL: 68.0

**Kerosine**
Range, °F.: 435-500
Yield, vol %: 6.70
Gravity, °API: 38.5
Sulfur, wt %: 0.76
Aromatics, vol %: 37
Freezing pt, °F.: −47
Smoke pt, mm: 18
Aniline pt, °F.: 137.7
Cetane index: 47.3
ASTM, 50% pt, °F.: 456

**Gas oil**
Range, °F.: 500-620
Yield, vol %: 12.63
Gravity, °API: 32.7
Sulfur, wt %: 1.76
Pour pt, °F.: −5
Aniline pt, °F.: 153.3
Cetane index: 52.0

**Residual oil**
Range, °F.: 620+
Yield, vol %: 63.45
Gravity, °API: 13.2
Sulfur, wt %: 4.45
Pour pt, °F.: +60
Con. carbon, wt %: 1.5

**Residual oil**
Range, °F.: 1,048+
Yield, vol %: 34.23
Gravity, °API: 6.2
Sulfur, wt %: 5.43
Con. carbon, wt %: 20.3
V/Ni, ppm: 120/25

## Dorrood (Darius), Iran

*Kharg Island*

**Crude**
Gravity, °API: 33.6
Sulfur, wt %: 2.35
Rvp, psi: 6.5
$H_2S$ (evolved), wt %: 0.026
Pour pt, °F.: −4.5
Rams. carbon, wt %: 4.6
Kin. vis., cSt @ 100° F.: 5.65
V/Ni, ppm: 23/8
$C_1$-$C_5$, vol %: 6.35

**Naphtha**
Range (TBP), °F.: $C_5$-200
Yield, vol %: 10.1
Gravity, °API: 81.9
Sulfur, wt %: 0.067
Charac. factor: 12.70
Paraffins, vol %: 85.6
Naphthenes, vol %: 12.2
Aromatics, vol %: 2.2
RON/MON, clear: 61.7/61.1

**Naphtha**
Range (TBP), °F.: 200-320
Yield, vol %: 12.7
Gravity, °API: 59.0
Sulfur, wt %: 0.088
Charac. factor: 12.07
P/N/A, vol %: 67.5/17.8/14.8
RON/MON, clear: 33.0/ 35.9

**Kerosine**
Range, °F.: 320-520
Yield, vol %: 18.6
Gravity, °API: 44.9
Sulfur, wt %: 0.462
Charac. factor: 11.88
Aniline pt, °F.: 142.9
Diesel index: 64.1
Cetane index: 46.3
Freeze pt, °F.: −41
Cloud pt, °F.: −44
Pour pt, °F.: −49
Smoke pt, mm: 24
Naphthalenes, vol %: 2.66
Neut. no., mg Kott/g: 0.20
Vis., SUS @ 68° F.: 32.7

**Gas oil**
Range, °F.: 520-650
Yield, vol %: 11.5
Gravity, °API: 33.7
Sulfur, wt %: 1.68
Charac. factor: 11.76
Aniline pt, °F.: 162.3
Diesel index: 54.6
Cetane index: 49.9
Cloud pt, °F.: 26
Pour pt, °F.: 21
Vis., SUS @ 68° F.: 47.0

**Residuum**
Range, °F.: 650+
Yield, vol %: 44.6
Gravity, °API: 14.5
Sulfur, wt %: 3.97
Pour pt: °F.: 58
Rams. carbon, wt %: 9.10
Vis., SUS @ 122° F.: 1,494.0
V/Ni, ppm: 45/16

**Residuum**
Range, °F.: 1,050+
Yield, vol %: 17.9
Gravity, °API: 3.8
Sulfur, wt %: 5.38
Pour pt, °F.: 141
V/Ni, ppm: 101/36

## Dubai (Fateh), Dubai, U.A.E.

*SBMs in offshore Persian Gulf producing area*

**Crude**
Gravity, °API: 31.05
Total sulfur, wt %: 2.0
Kin. vis., cSt @ 20° C.: 12.82
@ 40° C.: 7.05
Rvp, bar: 0.419
Pour pt, °C.: −9
Asphaltenes, wt %: 1.70
Con. carbon, wt %: 4.62
V/Ni, ppm: 42/14

**Debutanized naphtha**
Range, °C.: 15-145
Yield, vol %: 16.4
Gravity °API: 75.0
Vol % position in crude: 2.0-18.4
Total sulfur, ppm: 193
Rvp, bar: 0.44
Paraffins, vol %: 68.4
Naphthenes, vol %: 23.1
Aromatics, vol %: 8.5
RON, clear: 55.6

**Kerosine**
Range, °C.: 145-230
Yield, vol %: 15.0
Total sulfur, wt %: 0.25
P/N/A, vol %: 50.9/29.9/19.2
Smoke pt, mm: 22
Aniline pt, °C.: 56.0
Diesel index: 62.1
Cetane index: 56.0

**Gas oil**
Range, °C.: 145-350
Yield, vol %: 36.6
Gravity, °API: 38.6
Total sulfur, wt %: 1.04
Kin. vis., cSt @ 20° C.: 3.02
@ 40° C.: 1.99
Aniline pt, °C.: 60.8
Diesel index: 54.6
Cetane index: 51.0

**Gas oil**
Range, °C.: 175-400
Yield, vol %: 39.9
Gravity, °API: 34.1
Total sulfur, wt %: 1.43
UOP factor: 11.65

**Residue**
Range, °C.: 350+
Yield, vol %: 45.0
Gravity, °API: 14.75
Total sulfur, wt %: 3.0
Kin. vis., cSt @ 50° C.: 351
@ 100° C.: 31.0
Pour pt, °C.: +19
Con. carbon, wt %: 9.1
V/Ni, ppm: 85/27

## Dukhan (Qatar Land), Qatar

*Umm Said terminal CBM & SBM*

**Crude**
Gravity, °API: 41.7
Sulfur, wt %: 1.28
$H_2S$ g/100 cc: 0.0283
Pour pt, °F.: −20
Rvp, psi: 11.7
Vis., SSU @ 80° F.: 43.3

**Gasoline**
Range, °F.: 40-155
Yield, vol %: 8.61
Gravity, °API: 86.5
Sulfur, wt %: 0.02
Paraffins, vol %: 95.0
Naphthenes, vol %: 3.9
Aromatics, vol %: 1.1

**Light naphtha**
Range, °F.: 155-265
Yield, vol %: 11.74
Gravity, °API: 64.3
Sulfur, wt %: 0.02
P/N/A, vol %: 67.8/19.7/12.5

**Heavy naphtha**
Range, °F.: 265-350
Yield, vol %: 10.65
Gravity, °API: 52.5
Sulfur, wt %: 0.03

P/N/A, vol %: 64.3/13.9/21.1
Dinaphthenes, vol %: 0.7
Smoke pt, calculated: 22.6

**Kerosine**
Range, °F.: 350-500
Yield, vol %: 15.83
Gravity, °API: 45.0
Cetane index (calculated): 51.1
Sulfur, wt %: 0.14
Aromatics, vol %: 21.1
Smoke pt: 21.0
Freeze pt, °F.: −42
Pour pt, °F.: −45

**Heavy gas oil**
Range, °F.: 500-650
Yield, vol %: 15.14
Cetane index (calculated): 55.1
Sulfur, wt %: 1.11
Total N, ppm: 35
Chloride, ppm: < 5.0
Pour pt, °F.: 15

**Residue**
Range, °F.: 650+
Yield, vol %: 32.66
Gravity, °API: 20.3
Sulfur, wt %: 2.58
Vis., SSU @ 210° F.: 73.2

**Residue**
Range, °F.: 650-1,000
Yield, vol %: 22.79
Gravity, °API: 24.1
Sulfur, wt %: 2.15
Total N, ppm: 525
Rams. carbon, wt %: 0.23
Vis., SSU @ 210° F.: 46.0

**Pitch**
Range, °F.: 1,000+
Yield, vol %: 9.87
Sulfur, wt %: 3.45
Con. carbon, wt %: 12.75
V/Ni, ppm: 19/3

## Eocene (Wafra), Divided Zone

*Mina Saud, Divided Zone CBM, also Mina Abdulla, Kuwait*

**Crude**
Gravity, °API: 18.6
Sulfur, wt %: 4.55
Pour pt, °F.: −20
Vis., Saybolt 122° F.: 80.4
Con. carbon, wt %: 8.9
Rvp, psi: 1.1
Salt content, lb/1,000 bbl: 7.0

**Light naphtha**
Range, °F.: Ibp-200
Yield, vol %: 1.50
Gravity, °API: 77.6
Sulfur, wt %: 0.12
Rvp, psi: 11.4
Paraffins, vol %: 70
Naphthenes, vol %: 29
Aromatics, vol %: 1
RON, clear: 78.0
ASTM, 50% pt, °F.: 154

**Heavy naphtha**
Range, °F.: 200-435
Yield, vol %: 11.82
Gravity, °API: 51.0
Sulfur, wt %: 0.27
Rvp, psi: 1.4
P/N/A, vol %: 45/40/15
RON, clear: 48
RON, 3 g TEL: 60
ASTM, 50% pt, °F.: 325

**Kerosine**
Range, °F.: 435-500
Yield, vol %: 5.97
Gravity, °API: 36.9
Sulfur, wt %: 1.0
Aromatics, vol %: 30
Freezing pt, °F.: −66
Smoke pt, mm: 17
Aniline pt, °F.: 133.2
Cetane index: 43
ASTM, 50% pt, °F.: 458

**Gas oil**
Range, °F.: 500-620
Yield, vol %: 11.15
Gravity, °API: 31.0
Sulfur, wt %: 1.80
Pour pt, °F.: −30
Aniline pt, °F.: 145.8
Cetane index: 47
ASTM, 50% pt, °F.: 562

**Residual oil**
Range, °F.: 620+
Yield, vol %: 68.03
Gravity, °API: 10.0
Sulfur, wt %: 4.9
Pour pt, °F.: 60
Con. carbon, wt %: 14.83

**Residual oil**
Range, °F.: 1,044+
Yield, vol %: 39.75
Gravity, °API: 4.6
Sulfur, wt %: 6.1
Con. carbon, wt %: 22.5
V/Ni, ppm: 135/67

## Foroozan (Fereidoon), Iran

*Kharg Island*

**Crude**
Gravity, °API: 31.3
Sulfur, wt %: 2.50
Rvp, psi: 5.7
$H_2S$ (evolved), wt %: 0.015
Pour pt, °F.: −35
Neut. no., mg KOH/g: 0.70
Rams. carbon, wt %: 5.4
Kin. vis., cSt @ 68°F.: 15.33
V/Ni, ppm: 36/11
$C_1$-$C_5$, vol %: 6.35

**Naphtha**
Range, °F.: $C_5$-200
Yield, vol %: 9.9
Gravity, °API: 82.6
Sulfur, wt %: 0.017
Charac. factor: 12.72
Paraffins, vol %: 76.8
Naphthenes, vol %: 21.8
Aromatics, vol %: 1.4
RON/MON, clear: 64.3/62.6

**Naphtha**
Range, °F.: 200-320
Yield, vol %: 10.5
Gravity, API: 58.1
Sulfur, wt %: 0.056
Charac. factor: 12.02
P/N/A, vol %: 71.6/17.2/11.3
RON/MON, clear: 30.2/32.0

**Kerosine**
Range, °F.: 320-520
Yield, vol %: 17.7
Gravity, °API: 44.3
Sulfur, wt %: 0.435
Charac. factor: 11.84
Aniline pt, °F.: 145.2
Diesel index, °F.: 64.3
Cetane index: 45.4
Freeze pt, °F.: −41
Cloud pt, °F.: −52
Pour pt, °F.: −52
Smoke pt, mm: 22
Vis., SUS @ 68° F.: 32.4

**Gas oil**
Range, °F.: 520-650
Yield, vol %: 10.8
Gravity, °API: 33.4
Sulfur, wt %: 1.56
Charac. factor: 11.74
Aniline pt, °F.: 161.2
Diesel index: 53.8
Cetane index: 49.4
Cloud pt, °F.: 20
Pour pt, °F.: 19
Vis., SUS @ 68° F.: 48.0

**Residuum**
Range, °F.: 650+
Yield, vol %: 48.8
Gravity, °API: 13.6
Sulfur, wt %: 4.13
Pour pt, °F.: 34
Rams. carbon, wt %: 9.86
Vis., SUS @ 122 °F.: 3,616.0
V/Ni, ppm: 66/20

**Residuum**
Range, °F.: 1,050+
Yield, vol %: 20.4
Gravity, °API: 3.8
Sulfur, wt %: 5.6
Pour pt, °F.: 158
V/Ni, ppm: 143/44

## Gulf of Suez Mix, Egypt

*Ras Shukheir/3 conventional sea berths*

**Crude**
Gravity, °API: 31.9
Sulfur, wt %: 1.52
Rvp, psi: 8.3
Pour pt, °F.: 35
Rams. carbon, wt %: 4.4
Kin. vis., cSt @ 100° F.: 8.74
V/Ni, ppm: 41/25
$C_1$-$C_5$, vol % yield: 5.48

**Naphtha**
Range (TBP), °F.: $C_5$-200
Yield, vol %: 7.8
Gravity, °API: 79.1
Total sulfur, wt %: 0.018
Rvp, psi: 10.7
Paraffins, vol %: 80.0
Naphthenes, vol %: 18.0
Aromatics, vol %: 2.0
RON, clear: 69.4
MON, clear: 66.1

**Naphtha**
Range (TBP), °F.: 200-320
Yield, vol %: 10.0
Gravity, °API: 56.7
Total sulfur, wt %: 0.022
Rvp, psi: 1.1
P/N/A, vol %: 57.3/32.7/10.1
RON, clear: 47.2
MON, clear: 43.9

**Kerosine**
Range (TBP), °F.: 320-520
Yield, vol %: 17.7
Gravity, °API: 42.6
Total sulfur, wt %: 0.395
Aniline pt, °F.: 138.6
Diesel index: 59.1
Cetane index: 43.0
Freeze pt, °F.: −48
Cloud pt, °F.: −42
Smoke pt, mm: 26
Naphthalenes, vol %: 2.88

**Gas oil**
Range (TBP), °F.: 520-650
Yield, vol %: 11.3
Gravity, °API: 33.9
Total sulfur, wt %: 1.2
Aniline pt, °F.: 159.1
Diesel index: 53.9
Cetane index: 50.21
Cloud pt, °F.: 26
Vis., SUS @ 68° F.: 49.8

**Gas oil**
Range (TBP), °F.: 650-850
Yield, vol %: 17.2
Gravity, °API: 27.2
Total sulfur, wt%: 1.6
Rams. carbon, wt %: 0.34

**Residuum**
Range, °F.: 650 +
Yield, vol %: 50.8
Gravity, °API: 17.2
Total sulfur, wt %: 2.365
Rams. carbon, wt %: 7.90
Vis., SUS @ 122° F.: 1,146.9
V/Ni, ppm: 73/46

## Hout, Divided Zone

*Sea berth off Ras Al Khafji*

**Crude**
Gravity, °API: 32.8
Sulfur, wt %: 1.91
Rvp, psi: 4.6
Pour pt, °F.: −13.0
Kin. vis., cSt @ 86° F.: 9.88
Con. carbon, wt %: 5.01
Asphaltenes, wt %: 1.65
Wax content, wt %: 3.2
Neut. no., mg KOH/g: 0.04
$C_1$-$C_4$, vol %: 1.8
V/Ni, ppm: 28/6

**Light naphtha**
Range (TBP), °F.: $C_5$-176
Yield, vol %: 6.3
Gravity, °API @ 60° F.: 83.7
Sulfur, wt %: 0.029
$H_2S$, ppm: 19
Rvp, psi: 10.3
RON, clear: 64.6
RON + 3.0 ml TEL/gal: 84.2
MON, clear: 61.0
Paraffins, vol %: 92.6
Naphthenes, vol %: 6.4
Aromatics, vol %: 1.0

**Full range naphtha**
Range (TBP), °F.: $C_5$-374
Yield, vol %: 24.5
Gravity, °API: 63.5
Sulfur, wt %: 0.035
$H_2S$, ppm: 26
Rvp, psi: 4.3
RON, clear: 44.0
MON, clear: 43.6
Aniline pt, °F.: 134
P/N/A, vol %: 70.8/15.6/13.6

**Kerosine**
Range, °F.: 374-482
Yield, vol %: 11.3
Gravity, API @ 60° F.: 445
Sulfur, wt %: 0.204
Pour pt, °F.: −49
Cloud pt, °F.: −49
Freeze pt, °F.: −42
Smoke pt, mm: 23.5
Aniline pt, °F.: 147
Saturates, vol %: 81.5
Aromatics, vol %: 18.0
Olefins, vol %: 0.5

**Gas oil**
Range, °F.: 482-644
Yield, vol %: 15.0
Gravity, °API @ 60° F.: 36.0
Sulfur, wt %: 1.07
Kin. vis. @ 100 °F.: 3.954
Pour pt, °F.: 14
Aniline pt, °F.: 163
Cetane index: 56.5

**Residue**
Range, °F.: 644 +
Yield, vol %: 47.4
Gravity, °API @ 60° F.: 16.4
Sulfur, wt %: 3.39
Kin. vis., cSt @ 122° F.: 360.3
Pour pt, °F.: 68
Con. carbon, wt %: 10.3
V/Ni, ppm: 58/13

**Residue**
Range, °F.: 1,022 +
Yield, vol %: 21.8
Gravity, °API @ 60° F.: 7.9
Sulfur, wt %: 4.39
Kin. vis., cSt @ 210° F.: 118.6
Pour pt, °F.: 91
Con. carbon, wt %: 20.7
Asphaltenes, wt %: 6.42
V/Ni,ppm: 110/31

## Iranian Heavy, Iran

*Kharg Island*

**Crude**
Gravity, °API: 31.0
Total sulfur, wt %: 1.65
Vis., cSt @ 70° F.: 16.84
Vis., cSt @ 100° F.: 9.36
Pour pt, °F.: −5
$C_1$-$C_4$ yield, vol %: 2.38

**Gasoline**
Range (TBP), °C.: $C_5$-65
Yield, vol %: 3.49
Sp. gr. 60/60 °F.: 0.6468
RON, clear: 73.0
Paraffins, wt %: 93.5
Naphthenes, wt %: 5.7
Aromatics, wt %: 0.8

**Light naphtha**
Range, °C.: 65-149
Yield, vol %: 14.53
Sp. gr., 60/60 °F.: 0.7392
Total sulfur, wt %: 0.088
P/N/A, wt %: 53.4/33.1/13.5

**Heavy naphtha**
Range, °C.: 149-262
Yield, vol %: 18.26
Sp. gr., 60/60 °F.: 0.8041
Total sulfur: 0.289
Freezing pt, °C.: −50.0
Aromatics, vol %: 17.8
Aniline pt, °C.: 59.1
Smoke pt, mm: 23

**Gas oil**
Range, °C.: 262-352
Yield, vol %: 14.60
Total sulfur, wt %: 1.22
Cloud pt, °F.: 28
Pour pt, °F.: 24
Diesel index: 52

**Residue**
Range, °C.: 352 +
Yield, vol %: 46.74
Total sulfur, wt %: 2.55
Vis., cSt @ 122° F.: 614
Vis, cSt @ 210° F.: 49.8
Con. carbon, wt %: 9.9
Asphaltenes, wt %: 3.8
V/Ni, ppm: 139/58

Assay sample taken at production rate of 1.84 million b/d with following field contributions in b/d:

Ahwaz—700,000
Gachsaran—628,000
Bibi Hakimeh—269,000
Kharg, Kupal, Monsuri and Rag E. Safid—251,000

## Iranian Light, Iran

*Kharg Island*

**Crude**
Gravity, °API: 33.8
Pour pt, °F.: −20
Total sulfur, wt %: 1.35
Vis., cSt @ 70° F.: 10.58
@ 130° F.: 4.22

**Gasoline**
Range, °C.: $C_5$-65
Yield, vol %: 3.86
Sp. gr. 60/60° F.: 0.6465
RON, clear: 72.4
Paraffins, wt %: 94.4
Naphthenes, wt %: 4.8
Aromatics, wt %: 0.8

**Light naphtha**
Range, °C.: 65-149
Yield, vol %: 14.17
Sp. gr. 60/60° F.: 0.7387
Total sulfur, wt %: 0.040
P/N/A, wt %: 57.5/31.1/11.4

**Heavy naphtha**
Range, °C.: 149-262
Yield, vol %: 20.45
Sp. gr., 60/60° F.: 0.8028
Total sulfur, wt %: 0.198
Freezing pt, °C.: − —49
Aromatics, vol %: 18.0
Aniline pt, °C: 60.3
Smoke pt, mm: 24

**Gas oil**
Range, °C.: 262-352
Yield, vol %: 15.32
Sp. gr. 60/60° F.: 0.8599
Total sulfur, wt %: 1.05
Cloud pt, °F.: 28
Pour pt, °F.: 24
Diesel index: 53

**Residue**
Range, °C.: 352 +
Yield, vol %: 43.3
Sp. gr. 60/60° F.: 0.9531
Total sulfur, wt %: 2.42
Vis., cSt @ 122° F.: 297.0
@ 210° F.: 29.8
Con. carbon, wt %: 9.0
Asphaltenes, wt %: 1.2
V/Ni, ppm: 70/32

Assay sample taken at production rate of 2.6 million b/d with following field contributions in b/d:

Agha Jari—870,000
Marun—1.03 million
Karanj—356,000
Paris—279,000
Pazanan—33,000

## Khafji, Divided Zone

*Sea berth off Ras Al Khafji*

**Crude**
Gravity, °API: 28.5
Sulfur, wt %: 2.85

$H_2S$ (dissolved), ppm: <1
Rvp, psi: 7.6
Pour pt, °F.: −31
Kin. vis., cSt @ 86° F.: 21.3
Con. carbon residue, wt %: 8.04
Asphaltenes, wt %: 4.32
Wax content, wt %: 2.7
Neut. no., mg KOH/g: 0.18
$C_1$-$C_4$, vol %: 3.41
V/Ni, ppm: 55/16

**Light naphtha**
Range (TBP), °F.: $C_5$-176
Yield, vol %: 5.5
Gravity, °API @ 60°F.: 85.2
Sulfur, wt %: 0.0028
Rvp, psi: 10.8
RON, clear: 66.2
RON + 1.0 ml TEL/gal: 78.5
MON, clear: 63.4
Paraffins, vol %: 93.9
Naphthenes, vol %: 5.4
Aromatics, vol %: 0.7

**Full range naphtha**
Range (TBP), °F.: $C_5$-374
Yield, vol %: 20.4
Gravity, °API @ 60° F.: 65.0
Sulfur, wt %: 0.0264
Rvp, psi: 4.3
RON, clear: 41.0
RON + 1 ml TEL/gal: 53.1
MON, clear: 41.2
Aniline pt, °F.: 139
P/N/A, vol %: 73.4/15.4/11.2

**Kerosine**
Range (TBP), °F.: 374-482
Yield, vol %: 9.5
Gravity, °API @ 60° F.: 44.5
Sulfur, wt %: 0.324
Cloud pt, °F.: −45
Freeze pt, °F.: −45
Smoke pt, mm: 23.7
Aniline pt, °F.: 145
Saturates, vol %: 80.5
Aromatics, vol %: 19.0
Olefins, vol %: 0.5

**Gas oil**
Range (TBP), °F.: 482-644
Yield, vol %: 13.9
Sulfur, wt %: 1.42
Kin. vis. @ 100° F.: 3.9
Pour pt, °F.: 10
Cloud pt, °F.: 10
Aniline pt, °F.: 156
Cetane index: 54.2

**Residue**
Range (TBP), °F.: 644+
Yield, vol %: 52.8
Gravity, °API @ 60° F.: 12.1
Sulfur, wt %: 4.46
Kin. vis., cSt @ 122° F.: 1,795
Pour pt, °F.: 50
Con. carbon, wt %: 13.4
Asphaltenes, wt %: 7.84
V/Ni, ppm: 95/28

**Residue**
Range (TBP), °F.: 991+
Yield, vol %: 27.8
Gravity, °API @ 60°F.: 4.5
Sulfur, wt %: 5.65
Kin. vis., cSt @ 210° F.: 6,043
Pour pt, °F.: 145
Con. carbon, wt %: 24.4
Asphaltenes, wt %: 15.4
V/Ni, ppm: 170/49

## Kirkuk Blend, Iraq

*Mina-al-Bakr sea terminal in Persian Gulf also Ceyhan (Dortyol), Turkey*

**Crude**
Gravity, °API: 35.1
Sulfur, wt %: 1.97
Pour pt, °C.: −22
Kin. vis., cSt @ 10° C.: 12.8
$C_4$ & lighter, wt %: 1.8

**Light SR naphtha**
Range, °C.: $C_5$-65
Yield, wt %: 4.1
Density @ 15° C., g/cu m: 0.644
RON + 0.4 g Pb/l: 81

**Heavy SR naphtha**
Range, °C.: 65-175
Yield, wt %: 18.1
Density @ 15° C., g/cu m: 0.740
RON + 0.4 g Pb/l: 58.5
Aromatics, vol %: 10.5
Naphthenes, vol %: 22

**Kerosine**
Range, °C.: 175-225
Yield, wt %: 8.7
Density @ 15° C., g/cu m: 0.794
Sulfur, wt %: 0.19

**Gas oil**
Range, °C.: 225-360
Yield, wt %: 24.0
Density @ 15° C., g/cu m: 0.843
Sulfur, wt %: 1.18
Pour pt, °C.: −12
Cold filter pour pt, °C.: −9
Kin. vis., cSt @ 100° C.: 1.34

**Heavy gas oil**
Range, °C.: 360-525
Yield, wt %: 22.9
Density @ 15° C., g/cu m: 0.917
Sulfur, wt %: 2.35
Kin. vis., cSt @ 100° C.: 7.98

**Long residuum**
Range, °C.: 360+
Yield, wt %: 43.3
Density @ 15° C., g/cu m: 0.968
Sulfur, wt %: 3.76
Kin. vis., cSt @ 100° C.: 42.9

**Short residuum**
Range, °C.: 525+
Yield, wt %: 20.4
Density @ 15° C., g/cu m: 1.003
Sulfur, wt %: 5.30
Kin. vis., cSt @ 100° C.: 1,550
Con. carbon, wt %: 21.0
V/Ni, ppm: 142/54

## Kuwait Export, Kuwait

*Mina al Ahmadi*

**Crude**
Gravity, °API: 31.4
Vis., SUV, sec @ 100° F.: 58.1
Pour pt, °F.: +5
Sulfur, wt %: 2.52
Ni/V (calc.), ppm: 8/30
Rvp, psi: 6.7
$H_2S$, wt %: <0.001
$C_1$-$C_4$ (GC analysis), vol %: 3.03

**Naphtha**
Range, °F.: Over point — 140
Yield, vol %: 3.80
Gravity, °API: 89.7
Sulfur, wt %: 0.04
RON (micro), clear: 71.8
RON + 3 ml TEL: 89.3

**Naphtha**
Range, °F.: 140-170
Yield, vol %: 2.26
Gravity, °API: 78.6
Sulfur, wt %: 0.02
Aniline pt, °F.: 147.7
RON, clear/+ 3 ml TEL: 58.2/80.40
Paraffins, vol %: 88.5
Monocycloparaffins, vol %: 9.9
Aromatics, total, vol %: 1.6

**Heavy naphtha**
Range, °F.: 170-310
Yield, vol %: 11.91
Gravity, °API: 62.1
Sulfur, wt %: 0.03
Aniline pt, °F.: 136.2
Paraffins, vol %: 70.1
Monocycloparaffins, vol %: 20.4
Dicycloparaffins, vol %: 0.4
Aromatics, total, vol %: 9.1

**Kerosine**
Range, °F.: 310-520
Yield, vol %: 18.43
Gravity, °API: 45.9
Pour pt, °F.: −45
Sulfur, wt %: 0.39
Aniline pt, °F.: 142.9
Cetane index: 53.8
Smoke pt, mm: 26

**Heating oil**
Range, °F.: 520-680
Yield, vol %: 14.89
Gravity, °API: 32.9
Vis., SUV, sec. @ 100° F.: 43.3
Pour pt, °F.: +20
Total N, ppm: 100
Sulfur, wt %: 1.98
Aniline pt, °F.: 160.2
Cetane index: 54.3

**Gas oil**
Range, °F.: 680-1,000
Yield, vol %: 24.09
Gravity, °API: 21.4
Pour pt, °F.: +100
Sulfur, wt %: 3.12
Total N, ppm: 900
Ni/V, ppm: <0.1/<0.1
Vis., SUV, sec @ 130° F.: 175.2
Rams. carbon residue, wt %: 0.47

**Residuum**
Range (VEFV), °F.: 1,000+
Yield, vol %: 21.78
Gravity, °API: 5.8
Sulfur, wt %: 5.11
V/Ni, ppm: 116/34
Vis., SUV, sec @ 250° F.: 3,394
Rams. carbon residue, wt %: 21.9

## Mubarek, Sharjah, U.A.E.

*Floating storage and loading facility in offshore producing area*

**Crude**
Gravity, °API: 37
Sulfur, wt %: 0.62
Rvp, psi: 4.8
Pour pt, °F.: 10
Salt, lb/1,000 bbl: 23
Vis., cSt @ 100° F.: 3.20
  @ 122° F.: 2.80
Gas, vol % of crude: 0.7

**Light straight run**
Range, °F.: ibp-220
Yield, vol %: 12.7
Octane, F-1 clear: 68.2
Gravity, °API: 72.2
Rvp, psi: 11.8
Sulfur, wt %: 0.01

**Light naphtha**
Range, °F.: 220-300
Yield, vol %: 9.1
Paraffins, vol %: 51.6
Naphthenes, vol %: 30.4
Aromatics, vol %: 18.0
Octane, F-1 clear: 50.5
Gravity, °API: 55.2
Sulfur, wt %: 0.01

**Heavy naphtha**
Range, °F.: 300-360
Yield, vol %: 7.2
P/N/A, vol %: 48.5/28.8/22.7
Gravity, °API: 49.9
Sulfur, wt %: 0.01

**Kerosine**
Range, °F.: 360-500
Yield, vol %: 17.6
Gravity, °API: 42.7
Smoke pt, mm: 25
Aniline pt, °F.: 134
Diesel index: 57.2
Pour pt, °F.: −55
Sulfur, wt %: 0.04
Vis., cSt @ 100° F.: 1.40

**Light gas oil**
Range, °F.: 500-700
Yield, vol %: 21.4
Gravity, °API: 32.6
Aniline pt, °F.: 156
Diesel index: 50.9
Pour pt, °F.: 20
Rams. carbon residue, wt %: 0.66
Sulfur, wt %: 0.66
Vis., cSt @ 100° F.: 4.55
  @ 210° F.: 1.54
Bromine no.: 0.6

**Residuum**
Range, °F.: 700+
Yield, vol %: 30.8
Gravity, °API: 19.6
Rams. carbon residue, wt %: 4.74
Sulfur, wt %: 1.18

**Residuum**
Range, °F.: 1,000+
Yield, vol %: 9.2
Gravity, °API: 12.2
Rams. carbon residue, wt %: 15.09
Sulfur, wt %: 1.43
V/Ni, ppm: 11.40/6.0

## Murban, Abu Dhabi

### *Port of Jebel Dhanna/4 CBM berths*

**Crude**
Gravity, °API: 40.45
Rvp @ 37.8° C., psia: 3.46
Pour pt, °C.: −24
Kin. vis., cSt @ 40° C.: 2.70
Sulfur, wt %: 0.78
V/Ni, ppm: <0.1/0.7
Con. carbon, wt %: 1.35
Charac. factor, $K_{UOP}$: 12.1

**Naphtha**
Range (TBP), °C.: 20-165
Yield, vol %: 27.4
Position on crude, vol %: 1.9-29.3
Gravity, °API: 63.47
Sulfur, ppm: 43
RON, clear: 50

**Naphtha**
Range (TBP), °C.: 20-180
Yield, vol %: 31.2
Position on crude, vol %: 1.9-33.1
Gravity, °API: 61.48
Sulfur, ppm: 64
RON, clear: 47

**Kerosine**
Range (TBP), °C.: 150-220
Yield, vol %: 16.6
Position on crude, vol %: 25.3-41.9
Gravity, °API: 18.22
Smoke pt, mm: 24
Freeze pt, °C.: −46
Aromatics, vol %: 21
Aniline pt, °C.: 55.2
Sulfur, wt %: 0.022

**Diesel**
Range (TBP), °C.: 220-350
Yield, vol %: 26.0
Gravity, °API: 37.37
Sulfur, wt %: 0.62
Cloud pt, °C.: −12
Pour pt, °C.: −12
Vis., cSt @ 100° C.: 1.25
Aniline pt, °C.: 72.3
Diesel index: 60.6
Cetane index: 60
Con. carbon on 10% residue, wt %: <0.01

**Residuum**
Range (TBP), °C.: 350+
Yield, vol %: 32.1
Gravity, °API: 22.72
Sulfur, wt %: 1.73
Vis., cSt @ 100° C.: 10.85
Con. carbon, wt %: 4.3
Asphaltenes, wt %: 0.15
Pour pt, °C.: +33
V/Ni, ppm: 0.4/2.0
Flash pt, °C.: 214
Nitrogen, wt %: 0.125

**Residuum**
Range (TBP), °C.: 540+
Yield, vol %: 9.3
Gravity, °API: 13.99
Sulfur, wt %: 2.20
Vis., cSt @ 50° C.: 3,340.
Con. carbon, wt %: 11.5
Asphaltenes, wt %: 0.74

## Oman Export, Oman

### *Mina al Fahal*

**Crude**
Gravity, °API: 36.3
Sulfur, wt %: 0.79
Pour pt, °F.: −15
Rvp, psi: 4.2
Vis., SUS @ 60° F.: 64.8
Yield, ibp to 113 °F., vol %: 3.63

**Fraction yields (partial)**
Range/vol %:
  390-450/6.73
  450-500/5.74
  500-550/5.64
  550-650/10.76

**Straight run**
Range, °F.: 113-220
Yield, vol %: 7.54
Gravity, °API: 70.4
RON + 3 cc Pb: 74.2
Sulfur, wt %: 0.0
Paraffins, vol %: 77.0
Naphthenes, vol %: 18.24
Aromatics, vol %: 4.8

**Naphtha**
Range, °F.: 220-390
Yield, vol %: 17.77
Gravity, °API: 55.3
Sulfur, wt %: 0.03
P/N/A, vol %: 67.6/21.3/10.1
Dinaphthenes, vol %: 1.0

**Kerosine**
Range, ° F.: 315-500
Yield, vol %: 20.56
Gravity, °API: 46.5
Sulfur wt %: 0.12
Aromatics, vol %: 12.9
Smoke pt, mm: 26
Freeze pt, °F.: −56
Pour pt, °F.: −70

**Light gas oil**
Range, °F.: 450-650
Yield, vol %: 22.14
Gravity, °API: 37.5
Cetane index: 57.0
Sulfur, wt %: 0.42
Total N, ppm: 31
Aniline pt, °F.: 168.3
Pour pt, °F.: −15

**Heavy gas oil**
Range, °F.: 650-1,000
Yield, vol %: 26.15
Gravity, °API: 26.8
Sulfur, wt %: 0.98
Total N, ppm: 516
Pour pt, °F.: 70
Carbon residue, wt %: 0.14

**Flashed residue**
Range, °F.: 1,000+
Yield, vol %: 16.03
Gravity, °API: 14.2
Sulfur, wt %: 1.96
Vis., SSF @ 210 °F.: 196.0

## Qatar Marine, Qatar

### *Halul Island*

**Crude**
Gravity, °API: 35.3
Sulfur, wt %: 1.57
Pour pt, °F.: 10
$H_2S$ g/100 cc: 0.0315
Vis., SSU @ 60° F.: 53.4

**Light straight run**
Range, °F.: 40-155
Yield, vol %: 6.45
Gravity, °API: 82.5
Sulfur, wt %: 0.05
P/N/A, vol %: 88.7/9.5/1.7

**Light naphtha**
Range, °F.: 155-265
Yield, vol %: 9.45
Sulfur, wt %: 0.03
Paraffins, vol %: 60.6
Naphthenes, vol %: 23.3
Aromatics, vol %: 16.1

**Heavy naphtha**
Range, °F.: 265-350
Yield, vol %: 10.07
Gravity, °API: 51.8
Sulfur, wt %: 0.04
P/N/A: 56.7/18.5/22.9
Dinaphthenes, vol %: 1.9

**Kerosine**
Range, °F.: 350-500
Yield, vol %: 16.28
Gravity, °API: 43.1
Cetane index (calculated): 47.5
Sulfur, wt%: 0.18
Aromatics, vol %: 24.0
Smoke pt, mm: 19.0
Freeze pt, °F.: −44
Pour pt, °F.: −50

**Heavy gas oil**
Range, °F.: 500-650
Yield, vol %: 15.50
Cetane index (calculated): 51.6
Sulfur, wt %: 1.24
Total N, ppm: 72
Pour pt, °F.: 25

**Residue**
Range, °F.: 650+
Yield, vol %: 39.53
Gravity, °API: 16.5
Sulfur, wt %: 2.73
Vis., SUS @ 210° F.: 121.5

**Residue**
Range, °F.: 1,000+
Yield, vol %: 19.33
Gravity, °API: 10.3
Sulfur, wt %: 3.4
Con. carbon, wt %: 12.5
V/Ni, ppm: 31/7

## Rostam, Iran

### *Lavan Island terminal*

**Crude**
Gravity, °API: 35.9
Vis., cSt @ 50° C.: 3.08
Pour pt, °C.: −22.5
Sulfur, wt %: 1.55
NaCl, wt%: 0.036

**Gasoline**
Range, °F.: Ibp-165
Yield, vol %: 24.2
RON, clear: 61.4

**Kerosine**
Range, °C.: 165-220
Yield, vol %: 11.2

**Gas oil**
Range, °C.: 220-310
Yield, vol %: 17.3

**Residuum**
Yield, vol %: 45.8
Pour pt, °C.: +12.5
Sulfur, wt %: 2.82
Carbon, wt %: 6.25

Note: Same assay first published in 1976.

## Salmon (Sassan), Iran*

### *Levan Island*

**Crude**
Gravity, °F.: 33.9
Paraffin, wt%: 1.9
Sulfur, wt %: 1.91
Pour pt, °F.: −5
Vis., SUS @ 77° F.: 52.1
@100° F.: 44.2
Bs&w: 17,550

**Straight-run gasoline**
Range, vapor-cut points, °F.: 50-200
Yield, vol %: 10.5
Gravity, °API: 77.6
Sulfur, wt %: 0.081
Mercaptan sulfur: 0.067
Octane no., F-1 clear: 61.0

**Naphtha**
Range, VCP, °F.: 200-375
Yield, vol %: 16.4
Gravity, °API: 53.3
Sulfur, wt %: 0.0820
Mercaptan S, wt %: 0.002
Aniline pt, °F.: 121.5
Octane no., F-1 clear: 35.4
Arom. + naphthenes, vol %: 41

**Kerosine**
Range VCP, °F.: 375-450
Yield, vol %: 7.5
Gravity, °API: 45.1
Sulfur, wt %: 0.19
Freezing pt, °F.: −50
Aniline pt, °F.: 137.9
Smoke pt, mm: 20
Kin. vis., cSt @ 60° F.: 2.05
@ 100° F.: 30

**Gas oil**
Range VCP, °F.: 450-700
Yield, vol %: 23.8
Gravity, °API: 34.1
Sulfur, wt %: 1.2
Pour pt, °F.: +15
Aniline pt, °F.: 153.3
Kin. vis., cSt @ 60° F.: 7.52
@ 100° F.: 4.03
Cetane no.: 56.3

**Residual oil**
Range VCP, °F.: 700+
Yield, vol %: 39.7
Gravity, °API: 15.3
Sulfur, wt %: 3.5
Pour pt, °F.: +75
Vis., SUS @ 210° F.: 154
@ 275° F.: 67.8
V + Ni, ppm: 44

**Residual oil**
Range, VCP, °F.: 1,070+
Yield, vol %: 12.0
Gravity, °API: 1.3
Sulfur, wt %: 5.0
Vis., SUS @ 210° F.: 8,000
@ 275° F.: 1,000
V + Ni, ppm: 127

* New assay not available. This one first published in OGJ in 1976. Sassan is produced from same reservoir as Abu Al Bu Khoosh.

## Sirri, Iran

### *Offshore terminal in Persian Gulf producing area*

**Crude**
Gravity, °API: 30.9
Kin. vis., cSt @ 10° C.: 20.3
@ 37.8° C.: 7.36
Pour pt, °C.: −9
Total sulfur, wt %: 2.3
Rvp, bars: 0.650
Paraffins, wt %: 3.43
Asphaltenes, wt %: 1.48
V/Ni/Fe, ppm: 41/12/3
Yield $C_1$—$C_5$, vol %: 7.14

**Light gasoline**
Range, °C.: $C_5$-80
Yield, vol %: 5.19
RON, clear: 64.1
Total sulfur, wt %: 0.0080

**Heavy gasoline**
Range, °C.: 80-180
Yield, vol %: 15.28
Paraffins, vol %: 59.0
Naphthenes, vol %: 30.0
Aromatics, vol %: 11.0
Sulfur, wt %: 0.078

**Kerosine**
Range, °C.: 180-225
Yield, vol %: 7.54
Smoke pt, mm (150°-225° C.): 18.50
Sulfur, wt %: 0.436

**Gas oil**
Range, °C.: 180-350
Yield, vol %: 29.61
Pour pt, °C.: −21
Total sulfur, wt %: 1.42
Aniline pt, °C.: 62.2
Diesel index (calculated): 51.9

**Residue**
Range, °C.: 350+
Yield, vol %: 46.33
Pour pt, °C.: +21
Kin. vis., cSt @ 50° C.: 375
@ 70° C.: 120
Total sulfur, wt %: 3.65
Asphaltenes, wt %: 3.01
Con. carbon, wt %: 9.53
V/Ni/Fe, ppm: 70/20/4

## Soroosh (Cyrus), Iran

### *Offshore terminal with SBM in production area*

**Crude**
Gravity, °API: 18.1
Sulfur, wt %: 3.3
Rvp, psi: 0.3
$H_2S$ (evolved), wt %: 0.007
Pour pt, °F.: 10
Neut. no., mg KOH/g: 0.50
Rams. carbon, wt %: 12.2
Kin. vis., cSt @ 68° F.: 1,381.4
V/Ni, ppm: 101/35
$C_1$-$C_5$, vol %: 1.32

**Naphtha**
Range, °F.: $C_5$-200
Yield, vol %: 3.3
Gravity, °API: 77.3
Sulfur, wt %: 0.008
Charac. factor: 12.49
Paraffins, vol %: 69.1
Naphthenes, vol %: 29.7
Aromatics, vol %: 1.1
RON/MON, clear: 73.5/70.6

**Naphtha**
Range, °F.: 200-320
Yield, vol %: 5.1
Gravity, °API: 57.8
Sulfur, wt %: 0.021
Charac. factor: 12.00
P/N/A, vol %: 49.0/42.2/8.8
RON/MON, clear: 49.9/50.5

**Kerosine**
Range, °F.: 320-520
Yield, vol %: 11.6
Gravity, °API: 42.5
Sulfur, wt %: 0.37
Charac. factor: 11.76
Aromatics, vol %: 15.7
Aniline pt, °F.: 140.8
Diesel index: 59.8
Cetane index: 44.6
Freeze pt, °F.: −46
Cloud pt, °F.: −41
Pour pt, °F.: −55
Smoke pt, mm: 25
Neut no., mg KOH/g: 0.10
Vis., SUS @ 68° F.: 32.6

**Gas oil**
Range, °F.: 520-650
Yield, vol %: 9.6
Gravity, °API: 33.0
Sulfur, wt %: 1.19
Charac. factor: 11.72
Aniline pt, °F.: 152.9
Diesel index: 50.5

Cetane index: 49.0
Cloud pt, °F.: 11
Pour pt, °F.: 6
Naphthalenes, vol %: 13.68
Vis., SUS @ 68 °F.: 47.9

**Residuum**
Range, °F.: 650°
Yield, vol %: 70.1
Gravity, °API: 9.2
Sulfur, wt %: 4.3
Pour pt, °F.: 99
Rams. carbon, wt %: 16.31
Vis., SUS @ 210° F.: 1,439.8
V/Ni, ppm: 135/47

**Residuum**
Range, °F.: 1,050+
Yield, vol %: 36.5
Gravity, °API: −0.2
Sulfur, wt %: 5.6
Pour pt, °F.: 213
V/Ni, ppm: 237/82

## Souedie, Syria

### *Tartus/CBMs*

**Crude**
Gravity, °API: 24.9
Sulfur, wt %: 3.82
Pour pt, °C.: −30
Kin. vis. @ 10° C.: 88.3
$C_4$ & lighter: 0.8

**Light SR naphtha**
Range, °C.: $C_5$-65
Yield, wt %: 3.2
Density @ 15° C., g/cu cm: 0.647
RON + 0.4 g Pb/l: 79.5

**Heavy SR naphtha**
Range, °C.: 65-175
Yield, wt %: 13.1
Density @ 15° C., g/cu m: 0.734
RON + 0.4 g Pb/l: 58
Naphthenes, vol %: 18
Aromatics, vol %: 10.5

**Kerosine**
Range, °C.: 175-225
Yield, wt %: 6.0
Density @ 15° C., g/cu m: 0.798
Sulfur, wt %: 0.38

**Gas oil**
Range, °C.: 225-360
Yield, wt %: 19.7
Density @ 15° C., g/cu m: 0.865
Sulfur, wt %: 2.50
Pour pt, °C.: −14
CFPP, °C.: −11
Kin. vis., cSt @ 100° C.: 1.40

**Heavy gas oil**
Range, °C.: 360-425
Yield, wt %: 9.8
Density @ 15° C., g/cu m: 0.925
Sulfur, wt %: 3.90
Kin. vis., cSt @ 100° C.: 4.3

**Long residuum**
Range, °C.: 360+
Yield, wt %: 57.2
Density @ 15° C., g/cu m: 1.015
Sulfur, wt %: 5.90
Kin. vis., cSt @ 100° C.: 330.0

**Short residuum**
Range, °C.: 425+
Yield, wt %: 47.4
Density @ 15° C., g/cu m: 1.040
Sulfur, wt %: 6.0
Kin. vis., cSt @ 100° C.: 1,800
Con. carbon residue, wt %: 21.5
V/Ni, ppm: 185/60

## Umm Shaif (Abu Dhabi Marine), Abu Dhabi

### *Das Island*

**Crude**
Gravity, °API: 37.4
Sulfur, wt %: 1.51
Pour pt, °C.: −30
Rvp @ 37.8° C., psia: 7.05
$H_2S$, ppm: <2
Asphalt, wt %: 0.13

**Light naphtha**
Range (TBP), °C.: $C_5$-80
Yield, vol %: 8.2
Gravity, °API: 83.1
Charac. factor K: 12.73
Sulfur, ppm : 1,030
RON, clear: 65
RON + 1.5 ml/v.s. gal TEL: 74.5
MON, clear: 61

**Heavy naphtha**
Range (TBP), °C.: 80-150
Yield, vol %: 13.7
Gravity, °API: 59.26
Sulfur, wt %: 0.052

**Kerosine**
Range (TBP), °C.: 150-230
Yield, vol %: 15.8
Gravity, °API: 47.53
Freeze pt, °C.: −53.0
Aniline pt, °C.: 54.6
Aromatics, vol %: 21.0
Smoke pt, mm: 23.0
Sulfur, wt %: 0.095

**Diesel**
Range (TBP), °C.: 230-375
Yield, vol %: 25.8
Gravity, °API: 34.49
Sulfur, wt %: 1.18
Pour pt, °C.: −12
Aniline pt, °C.: 69.6
Diesel index: 54.8
Cetane index: 51.2

**Residue**
Range (TBP), °C.: 350+
Yield, vol %: 37.4
Gravity, °API: 19.1
Kin. vis., cSt @ 50° C.: 104.7
Pour pt, °C.: +27
Sulfur, wt %: 2.78
Asphaltenes, wt %: 0.1
Con. carbon, wt %: 5.3
V/Ni, ppm: 7.1/1.9

**Residue**
Range (TBP), °C.: 550+
Yield, vol %: 12.3
Gravity, °API: 10.15
Kin. vis., cSt @ 100° C.: 315
Pour pt, °C.: +21
Sulfur, wt %: 3.73
Asphaltenes, wt %: 0.24
Con. carbon, wt %: 14.4
V/Ni, ppm: 19.0/5.0

## Zakum (Lower Zakum/ Abu Dhabi Marine), Abu Dhabi

### *Das Island*

**Crude**
Gravity, °API: 40.6
Rvp @ 37.8 °C., psia: 8.37
Pour pt, °C.: −21
Kin. vis., cSt @ 20° C.: 4.28
Sulfur, wt %: 1.05
Charac. factor, $K_{UOP}$: 12.28
Asphaltene content, wt %: 0.05

**Light straight run**
Range (TBP), °C.: $C_5$-80
Yield, vol %: 8.6
Gravity, API: 82.7
Rvp @ 100 °F., psia: 11.6
Sulfur, ppm: 1.5
RON, clear: 66
MON, clear: 64

**Naphtha**
Range (TBP), °C.: $C_5$-160
Yield, vol %: 25.60
Gravity, °API: 66.5
Sulfur, ppm: 16.0

**Kerosine**
Range (TBP), °C.: 160-250
Yield, vol %: 18.8
Gravity, °API: 46.15
Kin. vis., cSt @ −20° C.: 4.10
Freeze pt, °C.: −48
Aniline pt, °C.: 58
Aromatics, vol %: 21.7
Smoke pt, mm: 23.5
Sulfur wt %: 0.063

**Diesel**
Range (TBP), °C.: 190-343
Yield, vol %: 29.30
Gravity, °API: 39.52
Sulfur, wt %: 0.52
Cloud pt, °C.: −18
Pour pt, °C.: −21
Vis., cSt @ 40° C.: 2.20
Aniline pt, °C.: 66.8
Diesel index: 60.2
Cetane index: 56.5

**Residue**
Range, °C.: 350+
Yield, vol %: 33.7
Gravity, °API: 21.8
Kin. vis., cSt @ 50° C.: 69.1
Pour pt, °C.: +33
Sulfur, wt %: 2.2
Asphaltenes, wt %: 0.2
Con. carbon, wt %: 4.0
V/Ni, mg/kg: 1.0/0.9

**Residue**
Range, °C.: 550+
Yield, vol %: 10.10
Gravity, °API: 13.2
Kin. vis., cSt @ 100° C.: 147.6
Pour pt, °C.: +18
Sulfur, wt %: 2.96
Asphaltenes, wt %: 1.0
Con. carbon, wt %: 13.6
V/Ni, mg/kg: 3.0/2.5

# North Sea

## Argyll, U.K. North Sea

### *SBM in producing area*

**Crude**
Density @ 15° C.: 0.8349
Sulfur, wt %: 0.18
Pour pt, °C.: +6
Vis., cSt @ 40° C.: 4.79

**Naphtha**
Range, °C.: Ibp—175
Yield, vol %: 25.2
Density @ 15° C.: 0.728
Sulfur, wt %: <0.001

**Kerosine**
Range, °C.: 175-260
Yield, vol %: 14.9

Density @ 15° C.: 0.804
Sulfur, wt %: 0.03
Copper strip test: 1.A
Smoke pt, mm: 22
Freeze pt, °C.: —37

**Gas oil**
Range, °C.: 260-360
Yield, vol %: 18.9
Density @ 15° C.: 0.839
Sulfur, wt %: 0.11
Cetane index: 64.5
Cloud pt, °C.: 0
Pour pt, °C: —3
Cold filter pt, °C.: —2
Vis., cSt @ 40° C.: 4.45

**Residue**
Range, °C.: 360+
Yield, vol %: 40.6
Density @ 15° C.: 0.9136
Sulfur, wt %: 0.34
V/Ni/Fe, ppm: 3.9/2.1/2.7
Pour pt, °C: +30
Vis., cSt @ 100° C.: 17.19

## Auk, U.K. North Sea

### *SBM in producing area*

**Crude**
Gravity, °API @ 60° F.: 37.15
Sulfur, wt %: 0.45
Wax, wt %: 6.5
Pour pt (ASTM max.), °C./°F.: +9/+50
Kin. vis., cSt @ 40° C.: 4.38
$H_2S$ existent/potential ppm: <1/<1
Acid value, mg KOH/g (TAN): 0.13
Rvp, lb: 6
$C_4$—, vol %/wt %: 2.2/1.5

**Gasoline**
Range, °C.: $C_5$—85
Yield, vol %/wt %: 8.0/6.5
Sp gr @ 15° C.: 0.685
RON, clear: 66
RON + 0.5 g Pb/l Pb: 82

**Naphtha**
Range, °C.: 85-165
Yield, vol %/wt %: 15.5/14.0
Sp gr @ 15° C.: 0.755
Sulfur, wt %: 0.002
P/N/A, wt %: 51/34/15

**Kerosine**
Range, °C.: 165-235
Yield, vol %/wt %: 13.0/12.5
Sp gr @ 15° C.: 0.802
Sulfur, wt %: 0.01
Smoke pt, mm: 25
Aromatics, vol %: 19

**Gas oil**
Range, °C.: 235-300
Yield, vol %/wt %: 12.5/12.4
Sp gr @ 15° C.: 0.828
Sulfur, wt %: 0.09
Cetane no.: 60
Cloud pt, °C: —19

**Gas oil**
Range, °C.: 300-350
Yield, vol %/wt %: 9.4/9.6
Sp gr @ 15° C.: 0.847
Sulfur, wt %: 0.35
Cetane no.: 63
Cloud pt, °C.: +9
Kin. vis., cSt @ 40° C.: 5.53

**Residue**
Range, °C.: 350+
Yield, vol %/wt %: 39.2/43.5
Sp gr @ 15° C.: 0.932
Sulfur, wt %: 0.93
Wax, wt %: 13
Pour pt, °C.: +45
Kin vis., cSt @ 60° C.:96.7
@ 100° C.: 20.7
Acid value: 0.15
Asphaltenes, wt %: 4.0
Con. car. residue: 7%
V/Ni, ppm: 14/3

## Beatrice, U.K. North Sea

### *Nigg Bay terminal*

**Crude**
Gravity, °API: 38.7
Sulfur, wt %: 0.05
Pour pt, °F.: 55
Rvp, psi.: 5.60
Vis., cSt @ 104° F.: 6.85
@ 122° F.: 5.15
$C_1$—$C_5$, yield, vol %: 3.77

**Light naphtha**
Range, VT °F.: 68-158
Yield, vol %: 3.6
Gravity, °API: 86.5
Rvp, psi: 7.9
RON, clear: 64.6
MON, clear: 63.2
Paraffins, vol %: 93.1
Naphthenes, vol %: 6.2
Aromatics, vol %: 0.7

**Naphtha**
Range, °F.: 158-212
Yield, vol %: 3.5
Gravity, °API: 67.0
Total sulfur, wt %: 0.0002
P/N/A, vol %: 63.7/32.0/4.3

**Heavy naphtha**
Range, °F.: 212-302
Yield, vol %: 7.3
Gravity, °API: 59.4
Total sulfur, wt %: 0.0004
P/N/A vol %: 69.2/18.6/12.2

**Kerosine**
Range, °F.: 302-401
Yield, vol %: 8.8
Gravity, °API: 52.4
Total sulfur, wt %: 0.0024
Smoke point, mm: 37
Freeze pt, °F.: —67
Cloud pt, °F.: —70
Pour pt, °F.: —75
Aniline pt, °F.: 148.4
Diesel index: 78
Aromatics, vol %: 8.5
Vis., cSt @ 100° F.: 1.08
@ 210° F.: 0.59

**Middle distillate**
Range, °F.: 401-509
Yield, vol %: 10.8
Gravity °API: 44.6
Total sulfur, wt %: 0.0081
Aniline pt, °F.: 163.9
Diesel index: 73
Cetane index: 59
Cloud pt, °F.: —4
Pour pt, °F.: —10
Vis., cSt @ 100° F.: 1.89
@ 212° F.: 0.88

**Middle distillate**
Range, °F.: 401-650
Yield, vol %: 25.8
Gravity, °API: 41.7
Total sulfur, wt %: 0.0191
Aniline pt, °F.: 176.8
Diesel index: 74
Cetane index: 65
Cloud pt, °F.: 38
Pour pt, °F.: 35
Vis., cSt @ 212° F.: 1.21

**Gas oil**
Range, °F.: 650-1,049
Yield, vol %: 34.7
Gravity, °API: 31.5
Total sulfur, wt %: 0.061
Aniline pt, °F.: 221.3
Con. carbon, wt %: 0.14
Pour pt, °F.: 105
Vis., cSt @ 212° F.: 5.03
V/Ni/Fe, wt ppm: 0.13/0.03/0.18

**Residue**
Range, °F.: 1,049+
Yield, vol %: 14.4
Gravity °API: 18.7
Total sulfur, wt %: 0.15
Con. carbon, wt %: 9.3
Vis., cSt @ 212° F.: 150
V/Ni/Fe, wt ppm: 0.95/4.20/16.50

## Beryl, U.K. North Sea

### *SBM in producing area*

**Crude**
Gravity, °API: 36.5
Kin. vis., cSt @ 59° F.: 9.47
Con. carbon residue, wt %: 1.3
Sulfur, wt %: 0.42
Rvp, psi: 5.2
V/Ni, ppm: 3.7/0.8
$C_5$ & lighter, vol %: 4.27

**Naphtha**
Range (TBP), °F.: 60-120
Yield, vol %: 2.29
Rvp, psi: 17.5
Paraffins, vol %: 97.5
Naphthenes, vol %: 2.5
Aromatics, vol %: 0.0
RON, clear: 80.5

**Naphtha**
Range, °F.: 120-330
Yield, vol %: 21.89
Sp gr, 60°/60° F.: 0.7519
Rvp, psi: 2.5
P/N/A, vol %: 48.7/33.8/17.6
RON, clear: 61.4
RON + 3 ml TEL: 81.6
Sulfur, wt %: 0.0014
Nitrogen, ppm: 2.2

**Kerosine**
Range, °F.: 330-425
Yield, vol %: 10.70
Sp gr: 0.7976
P/N/A, vol %: 42.5/36.4/21.1
Sulfur, wt %: 0.0168

**Light gas oil**
Range, °F.: 425-650
Yield, vol %: 24.75
Sp gr: 0.8441
Gravity, °API: 36.1
Pour pt, °F.: 5
Aniline pt, °F.: 155.5
Diesel index: 56
Cetane index: 51
Sulfur, wt %: 0.21

**Heavy gas oil**
Range, °F.: 650-995
Yield, vol %: 25.89
Gravity, °API: 26.1
Sp gr: 0.8981
Pour pt, °F.: 95
Kin. vis., cSt @ 100° F.: 38.30
Aniline pt, °F.: 190.8
Total nitrogen, ppm: 1,317

**Residue**
Range, °F.: 995+
Yield, vol %: 12.95
Gravity, °API: 14.4
Sp gr, 60/60° F.: 0.9698
Pour pt, °F.: 120
Kin. vis., cSt @ 100° F.: 14,827.95
Sulfur, wt %: 1.04
Con. carbon, wt %: 8.80
V/Ni, ppm: 24.0/5.7

**Residue**
Range, °F.: 650+
Yield, vol %: 38.85
Gravity, °API: 22.0
Sp gr: 0.9220
Pour pt, °F.: 100
Kin. vis., cSt @ 100° F.: 190.47
Sulfur, wt %: 0.78
Total nitrogen, ppm: 2,258
Con. carbon, wt %: 3.14
V/Ni, ppm: 8.4/2.0

## Brae, U.K. North Sea

*Scheduled to join Forties system in mid 1983*

**Crude**
Gravity, °API: 33.6
Sulfur, wt %: 0.73
Vis., cSt @ 10° C.: 13.6
Pour pt., °C.: —6
Carbon residue, wt %: 2.3
Asphaltenes, wt %: 0.35
V/Ni, ppm wt: 2.5/0.4
$C_1$—$C_4$, wt %: 2.15

**Gasoline**
Range (TBP), °C.: $C_5$—95
Yield, vol %: 9.25
Density @ 15° C., kg/l: 0.6985

**Naphtha**
Range, °C.: $C_5$—149
Yield, vol %: 21.45
Density @ 15° C., kg/l: 0.7405
Sulfur, wt %: 0.0005
P/N/A, wt %: 51.4/30.9/25.6

**Kerosine**
Range, °C.: 149-232
Yield, vol %: 15.2
Density @ 15° C., kg/l: 0.8125
Sulfur, wt %: 0.034
Aromatics, vol %: 25.7
Smoke pt, mm: 21
Cold test, °C.: —62
Aniline pt, °C.: 45.5
Diesel index: 49
Cetane index: 40

**Gas oil**
Range, °C.: 232-342
Yield, vol %: 21.3
Density @ 15° C., kg/l: 0.864
Sulfur, wt %: 0.55
Cloud pt, °C.: —15
Pour pt, °C.: —18
Acidity, mg KOH/g: 0.02
Aniline pt, °C.: 60.6
Diesel index: 45
Cetane index: 47

**Residue**
Range, °C.: 342+
Yield, vol %: 39.3
Density @ 15° C., kg/l: 0.9435
Sulfur, wt %: 1.41
Vis., cSt @ 50° C.: 128
Pour pt, °C.: 36
Carbon residue, wt %: 5.5
Asphaltenes, wt %: 0.75
V/Ni, ppm wt: 6.5/0.9

**F.C.C. feed**
Range, °C.: 369-509
Yield, vol %: 20.55
Density @ 15° C., kg/l: 0.921
Vis., cSt @ 100° C.: 7.22
Wax, wt %: 14
Aniline pt, °C.: 79.2

Note: Assay run on preproduction crude sample.

## Brent, U.K. North Sea

*Brent system to Sullom Voe and SPAR in producing area*

**Crude**
Gravity, °API @ 60° F.: 38.16
Sulfur, wt %: 0.26
Wax, wt %: 6.5
Pour pt (ASTM max.), °C.: —3
Kin vis., @ 40° C., cSt: 3.72
$H_2S$ existent/potential, ppm: <1/<1
Acid value, mg KOH/g (TAN): 0.05
Rvp, lb: 8.5
$C_4$—, vol %: 3.2

**Gasoline**
Range, °C.: $C_5$—85
Yield, vol %: 7.5
Sp gr @ 15° C.: 0.692
RON, clear: 71
RON + 0.5 g Pb/l Pb: 85

**Naphtha**
Range, °C.: 85-165
Yield, vol %: 17.7
Sp gr @ 15° C.: 0.769
Sulfur, wt %: 0.003
P/N/A, wt %: 42/34/24

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 13.5
Sp gr @ 15° C.: 0.806
Sulfur, wt %: 0.01
Smoke pt, mm: 23
Aromatics, vol %: 21

**Gas oil**
Range, °C.: 235-300
Yield, vol %: 12.9
Sp gr @ 15° C.: 0.840
Sulfur, wt %: 0.05
Cetane index: 52
Cloud pt, °C.: —19

**Gas oil**
Range, °C.: 300-350
Yield, vol %: 9.2
Sp gr @ 15° C.: 0.860
Sulfur, wt %: 0.25
Cetane index: 57.5
Cloud pt, °C.: +6
Kin. vis., cSt @ 40° C.: 6.36

**Residue**
Range, °C.: 350+
Yield, vol %: 36.5
Sp gr @ 15° C.: 0.913
Sulfur, wt %: 0.55
Wax, wt %: 13
Pour pt, °C.: +36
Kin. vis., cSt @ 40° C.: 51.8
@ 100° C.: 13.5
Acid value 0.08
Asphaltenes, wt %: 0.05
V/Ni, ppm: 4/1.5

Note: This is assay of unblended Brent crude loaded at offshore SPAR.

## Brent Blend, U.K. North Sea

*Sullom Voe Terminal, Shetlands*

**Crude**
Gravity, °API: 38.0
Vis., cSt @ 20° C.: 5.67
@ 37.8° C: 3.64
Pour pt, °C.: —15
Rvp, psig: 12.8
Sulfur, wt %: 0.38
Wax, wt %: 5.2
Asphaltenes, wt %: 0.26
V/Ni/Fe, ppm: 3.8/0.80/0.10

**Light naphtha**
Range, °C.: $C_5$—75
Yield, vol %: 6.2
Gravity, °API; 78.3
RON, clear: 72.0
Paraffins, wt %: 79.2
Olefins, wt %: Nil
Naphthenes, wt %: 16.8
Aromatics, wt %: 4.0

**Naphtha**
Range, °C.: $C_5$—165
Yield, vol %: 24.5
Gravity, °API: 60.1
Sulfur, ppm: 15
P/O/N/A, wt %: 59.0/Nil/33.0/8.0

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 12.6
Gravity, °API: 45.0
Sulfur, wt %: 0.043
Smoke pt, mm: 26
Freeze pt, °C.: —56
Aromatics, vol %: 17.9

**Gas oil**
Range, °C.: 165-350
Yield, vol %: 33.3
Gravity, °API: 39.1
Sulfur, wt %: 0.14
Cetane index: 53.0
Pour pt, °C.: —21
Vis., cSt @ 37.8° C.: 2.37
@ 50° C.: 1.92
Aniline pt, °C.: 66.8

**Gas oil**
Range, °C.: 235-350
Yield, vol %: 20.7
Gravity, °API: 35.7
Sulfur, wt %: 0.19
Cetane index: 54.0
Pour pt, °C.: —12
Vis., cSt @ 37.8° C: 3.79
@ 50° C.: 2.94
Aniline pt, °C.: 71.4

**Vaccum gas oil**
Range, °C.: 350-550
Yield, vol %: 28.3
Gravity, °API: 26.1
Sulfur, wt %: 0.57
Vis., cSt @ 100° F.: too waxy
Pour pt, °C.: +39
Con. carbon, wt %: 0.29
V/Ni/Fe, ppm: 0.05/0.02/0.14
UOP K factor: 12.3

**Residue**
Range, °C 550+
Yield, vol %: 10.3
Gravity, °API: 11.5
Sulfur, wt %: 1.35
Vis., cSt @ 37.8° C.: too waxy
Wax content, wt %: 10.1
Pour pt, °C.: +42
Con. carbon, wt %: 15.7
V/Ni/Fe, ppm: 25/5.7/0.96

Note: Analysis run on sample from tanker at Sullom Voe mid October 1981. Contributors to Brent Blend in early 1983 were North and South Cormorant, Brent, Dunlin, Thistle, and Murchison.

## Buchan, U.K. North Sea

*CALM in producing area*

**Crude**
Gravity, °API: 33.7
Sulfur, wt %: 0.84
Vis., cSt @ 20° C.: 20.37
Pour pt, °C.: 6
Carbon residue, wt %: 5.0
Total $C_1$—$C_4$, yield, wt %: 1.50
V/Ni, ppm wt %: 19/4

**Gasoline**
Range (TBP), °C.: $C_5$—95
Yield, vol %: 9.45
Paraffins, wt %: 71.2
Naphthenes, wt %: 24.5
Aromatics, wt %: 4.3

**Naphtha**
Range, °C: $C_5$—149
Yield, vol %: 19.9
Sulfur, wt %: 0.0009
P/N/A, wt %: 58.1/31.9/10.0

**Kerosine**
Range, °C.: 149-232
Yield, vol %: 14.45
Density @ 15° C., kg/l: 0.7965
Sulfur, wt %: 0.037
Aromatics, vol %: 18.8
Smoke pt, mm: 24
Aniline pt, °C.: 54.9
Diesel index: 60
Cetane index: 45

**Gas oil**
Range, °C.: 232-342
Yield, vol %: 20.55
Density @ 15° C., kg/l: 0.8465
Sulfur, wt %: 0.43
Vis., cSt @ 50° C.: 2.72
Pour pt, °C: —15
Aniline pt, °C: 68.0
Diesel index: 55
Cetane index: 54

**Gas oil**
Range, °C: 342-369
Yield, vol %: 4.2
Sulfur, wt %: 0.93
Pour pt: °C.: 15
Aniline, pt, °C.: 74.9
Diesel index: 50
Cetane index: 57

**Gas oil**
Range, °C.: 369-509
Yield, vol %: 20.15
Density @ 15° C., kg/l: 0.9055
Sulfur, wt %: 1.06
Vis., cSt @ 60° C.: 21.1
@ 100° C.: 6.76
Wax, wt %: 12.5
Aniline pt, °C.: 84.6

**Residue**
Range, °C.: 342+
Yield, vol %: 43.25
Density @ 15° C., kg/l: 0.950
Sulfur, wt %: 1.56
Vis., cSt @ 50° C.: 304
Pour pt, °C.: 36
Carbon residue, wt %: 10.5
V/Ni, wt ppm: 39/8
V/Ni, wt ppm: (509+ °C.): 84/18
Sulfur, wt % (509+ °C.): 2.17

## Cormorant, North, U.K. North Sea

*Brent system to Sullom Voe*

**Crude**
Gravity, °API: 34.9
Density @ 15° C., kg/l: 0.850
Sulfur, wt %: 0.71
Pour pt, °C.: +12
Kin. vis., @ 40° C., sq mm/sec: 5.76
Acid value, mg KOH/g (TAN): <0.05
$C_4$—, vol %: 2.6

**Gasoline**
Range, °C.: $C_5$—85
Yield, vol %: 7.0
Density @ 15° C.: 0.677
RON, clear: 69
RON + 0.5 g Pb/l: 84

**Naphtha**
Range, °C.: 85-165
Yield, vol %: 14.5
Density @ 15° C.: 0.759
Paraffins, wt %: 49
Naphthenes, wt %: 39
Aromatics, wt %: 20

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 11.7
Density @ 15° C: 0.804
Sulfur, wt %: 0.04
Smoke pt, mm: 24
Aromatics, vol %: 20

**Gas oil**
Range, °C.: 235-300
Yield, vol %: 12.5
Density @ 15° C.: 0.837
Sulfur, wt %: 0.24
Cetane index: 53
Cloud pt, °C.: —23

**Gas oil**
Range, °C: 300-350
Yield, vol %: 9.4
Density @ 15° C.: 0.860
Sulfur, wt %: 0.56
Cetane index: 58
Cloud pt, °C.: +8
Kin. vis., @ 40° C., sq mm/sec: 5.92

**Residue**
Range, °C.: 350+
Yield, vol %: 42.7
Density @ 15° C.: 0.916
Sulfur, wt %: 0.56
Wax, wt %: 12
Pour pt, °C.: +36
Kin. vis., @ 60° C., sq mm/sec: 101
@ 100° C.: 20.0
Acid value: 0.05
Asphaltenes, wt %: 0.66
Con. carbon, wt %: 5.4
V/Ni, ppm: 23/11

Note: This was designated a provisional assay in early 1983.

## Cormorant, South (Cormorant "A"), U.K. North Sea

*Brent system to Sullom Voe*

**Crude**
Gravity, °API: 35.7
Density @ 15° C. (kg/l): 0.846
Sulfur, wt %: 0.56
Pour pt, °C.: —6
Kin. vis., @ 40° C. sq mm/sec: 5.0
Acid value, mg KOH/g (TAN): 0.05
$C_4$—, vol %: 2.8

**Gasoline**
Range, °C.: $C_5$—85
Yield, vol %: 7.5
Density @ 15° C.: 0.679
RON, clear: 71
RON + 0.5 g Pb/l: 85

**Naphtha**
Range, °C.: 85-165
Yield, vol %: 15.4
Density @ 15° C.: 0.764
Sulfur, wt %: 0.001
Paraffins, wt %: 44
Naphthenes, wt %: 39
Aromatics, wt %: 17

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 12.9
Density @ 15° C.: 0.806
Sulfur, wt %: 0.03
Smoke pt, mm: 21
Aromatics, vol %: 21

**Gas oil**
Range, °C.: 235-300
Yield, vol %: 13.4
Density @ 15° C.: 0.840
Sulfur, wt %: 0.16
Cetane index: 51.5
Cloud pt, °C.: —18

**Gas oil**
Range, °C.: 300-350
Yield, vol %: 7.9
Density @ 15° C.: 0.863
Sulfur, wt %: 0.49
Cetane index: 52
Cloud pt, °C.: +5
Kin. vis., @ 40° C., sq mm/sec: 6.27

**Residue**
Range, °C.: 350+
Yield, vol %: 40.5
Density @ 15° C.: 0.931
Sulfur, wt %: 1.06
Wax, wt %: 10
Pour pt, °C.: 36
Kin. vis., @ 60° C., sq mm/sec.: 81.1
@ 100° C.: 16.1
Acid value: 0.1
Asphaltenes, wt %: 0.55
V/Ni, ppm: 3/21

## Dan, Denmark North Sea

*Contributor to Gorm Blend*

**Crude**
Gravity, °API: 30.4
Sulfur, wt %: 0.34
Vis., cSt @ 40° C.: 8.90
Pour pt, °F.: <-45
$C_4$ & lighter, vol %: 0.8

**Light gasoline**
Range.° F.: $C_5$—200
Yield, vol %: 5.8%
Density, kg/l: 0.714
Sulfur, wt %: 0.002
RON, clear: 80.0

**Naphtha**
Range, °F.: 200-405
Yield, vol %: 20.3
Density, kg/l: 0.791
Sulfur, wt %: 0.05
RON, clear: 63.7

**Light gas oil**
Range, °F.: 405-650
Yield, vol %: 26.6
Density, kg/l: 0.868
Sulfur, wt %: 0.19
Pour pt, °F.: —45

**Heavy gas oil**
Range, °F.: 650-1,000
Yield, vol %: 30.0
Density, kg/l: 0.920
Sulfur, wt %: 0.42
Pour pt, °F.: 60
Vis., cSt @ 50° C.: 44.2

**Atmospheric resid**
Range, °F.: 650+
Yield, vol %: 46.5

Density, kg/l: 0.942
Sulfur, wt %: 0.55
*Pour pt*, °F.: 45
Vis., cSt @ 50° C.: 269
Carbon residue, wt %: 5.0

**Vacuum residue**
Range, °F.: 1,000+
Yield, vol %: 16.5
Density, kg/l: 0.977
Sulfur, wt %: 0.70
Pour pt, °F.: 100
Vis., cSt @ 100° C.: 326

## Dunlin, U.K. North Sea

*Brent system to Sullom Voe*

**Crude**
Gravity, °API @ 60° F.: 34.9
Sulfur, wt %: 0.39
Wax, wt %: 5.0
Pour pt (ASTM max.), °C.: +6
Kin. vis., cSt @ 40° C.: 4.92
$C_4$—, vol %: 2.3

**Gasoline**
Range, °C.: $C_5$—85
Yield, vol %: 6.8
Sp gr @ 15° C.: 0.682
RON, clear: 69

**Naphtha**
Range, °C.: 85-165
Yield, vol %: 15.2
Sp gr @ 15° C.: 0.761
P/N/A, wt %: 42/43/15

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 11.8
Sp gr @ 15° C.: 0.809
Sulfur, wt %: 0.025
Smoke pt, mm: 22
Aromatics, vol %: 21

**Gas oil**
Range, °C.: 235-300
Yield, vol %: 13.0
Sp gr @ 15° C.: 0.846
Sulfur, wt %: 0.13
Cetane index: 50
Cloud pt, °C.: —25

**Gas oil**
Range, °C.: 300-350
Yield, vol %: 10.0
Sp gr @ 15° C.: 0.864
Sulfur, wt %: 0.32
Cetane index: 56
Cloud pt, °C.: —1
Kin. vis., cSt @ 40° C.: 6.3

**Residue**
Range, °C.: 350+
Yield, vol %: 41.2
Sp gr @ 15° C.: 0.930
Sulfur, wt %: 0.74
Wax, wt %: 10
Pour pt, °C.: +33
Vis. kin., cSt @ 60° C.: 82.4
@ 100° C.: 18.3
Acid value: 0.2
Asphaltenes, wt %: 0.24
V/Ni, ppm wt %: 5/2

## Ekofisk, Norway North Sea

*Seal Sands, Teesside, U.K. terminal*

**Crude**
Gravity, °API: 43.4
Sulfur, wt %: 0.14
Pour pt, °F.: 10
Vis., SUS @ 70° F.: 36.1
Rvp, psig: 5.0
Yield, $C_1$—$C_5$, wt %: 6.43

**Gasoline**
Range, °F.: Ibp—176
Yield, vol %: 11.9
RON, clear: 66

**Naphtha**
Range, °F.: 176-302
Yield, vol %: 20.2
Gravity, °API: 57.9
Paraffins, vol %: 53.1
Naphthenes, vol %: 36.8
Aromatics, vol %: 10.1
Sulfur, ppm: 3

**Kerosine**
Range, °F.: 302-400
Yield, vol %: 10.6
Gravity, °API: 48.7
Total sulfur, wt %: 0.002
Aniline pt, °F.: 137
Smoke pt, °F.: 23
Freezing pt, °F.: —85

**Gas oil**
Range, °F.: 400-662
Yield, vol %: 23.4
Gravity, °API: 38.0
Vis., cSt @ 100° F.: 3.01
Pour pt, °F.: 0
Aromatics, vol %: 17
Total sulfur, wt %: 0.07
Aniline pt, °F.: 162
Diesel index: 62

**Gas oil**
Range, °F.: 302-707
Yield, vol %: 37.3
Gravity, °API: 40.2
Pour pt, °F.: 5

**Heavy gas oil**
Range, °F.: 707-977
Yield, vol %: 13.2
Gravity, °API: 25.0
Vis., cSt @ 122° F.: 34.05
Pour pt, °F.: 97
Total sulfur, wt %: 0.25
Con. carbon, wt %: 0.047
Aniline, °F.: 200.5
V/Ni/Fe, ppm: 0.8/0.3/0.3

**Residue**
Range, °F.: 707+
Yield, vol %: 25.2
Gravity, °API: 20.9
Vis., SUS @ 212° F.: 117.2
Pour pt, °F.: 97
Sulfur, wt %: 0.40
Con. carbon, wt %: 4.3
V/Ni/Fe, ppm: 0.4/5.7/1.2

Note: Seven fields contribute to the Ekofisk Blend, which this assay represents. They are Ekofisk, West Ekofisk, Cod (pure gas condensate), Tor, Eldfisk, Edda, and Albuskjell. Condensate is not included in gasoline and naphtha blends listed.

## Flotta, U.K. North Sea

*Flotta terminal, Orkney Islands*

**Crude**
Gravity, °API: 35.7
Sulfur, wt %: 1.14
Vis., cSt @ 40° F.: 30.8
@ 104° F.: 4.38
Pour pt, °F.: 21.0
$C_4$ & lighter, vol %: 4.3
Rvp @ 100° F., psi: 9.1

**Naphtha**
Range, °F.: $C_5$-149
Yield, vol %: 5.0
*Sulfur, wt %: 0.001*
Paraffins, vol %: 94.5
Naphthenes, vol %: 3.5
Aromatics, vol %: 1.5
RON, clear: 73.0
RON + 0.4 g Pb/l: 86.0
Rvp @ 100° F., psi: 18.2

**Naphtha**
Range, °F.: 149-302
Yield, vol %: 14.9
Gravity, °API: 59.9
Sulfur, wt %: 0.001
P/N/A, vol %: 66.0/27.5/16.0
RON, clear: 58.0

**Naphtha**
Range, °F.: 302-356
Yield, vol %: 5.6
Gravity, °API: 50.0
Sulfur, wt %: 0.04
Rvp @ 100° F., psi: 0.6
P/N/A, vol %: 49.5/30.5/19.5
Smoke pt, mm: 23
Freeze pt, °F.: −76

**Kerosine**
Range, °F.: 356-455
Yield, vol %: 8.0
Gravity, °API: 44.1
Sulfur, wt %: 0.11
Vis., cSt @ 104° F.: 1.23
Aromatics, vol %: 23.0
Smoke pt, mm: 20.5
Freeze pt, °F.: −48
Aniline pt, °F.: 129
Cloud pt, °F.: −66

**Gas oil**
Range, °F.: 455-572
Yield, vol %: 11.8
Gravity, °API: 37.0
Sulfur, wt %: 0.51
Vis., cSt @ 104° F.: 2.3
Aromatics, vol %: 28.0
Aniline pt, °F.: 141
Cloud pt, °F.: −10

**Gas oil**
Range, °F.: 572-650
Yield, vol %: 8.4
Gravity, °API: 32.5
Sulfur, wt %: 1.05
Vis., cSt @ 104° F: 4.78
Aromatics, vol %: 36.0
Aniline pt, °F.: 157
Cloud pt, °F.: 29

**Gas oil**
Range, °F.: 650-1,000
Yield, vol %: 28.5
Gravity, °API: 23.2
Sulfur, wt %: 1.69
Vis., cSt @ 122° F.: 25.8
Pour pt, °F.: 91
Aniline, pt °F.: 171
Con. carbon residue, wt %: 0.29
V/Ni/Fe, ppm: <1/1/2

**Residue**
Range, °F.: 650+
Yield, vol %: 42.0
Gravity, °API: 18.3
Sulfur wt %: 2.08
Vis., cSt @ 104° F.: 220
@ 122° F.: 127
Pour pt, °F.: 86
Aniline pt °F.: 173
Con. carbon, wt %: 5.9
V/Ni/Fe: <3/7/3

Note: Flotta is a blend made up of Piper, Claymore, and Tartan crudes. Tartan appears in this section while Piper and Flotta (before introduction of Tartan) are in OGJ, Dec. 3, 1979, p. 102.

## Forties, U.K. North Sea

*Hound Point terminal, Firth of Forth*

**Crude**
Gravity, °API: 36.6
Sulfur, wt %: 0.30
Vis., cSt @ 10° C.: 9.6
@ 21.1° C.: 6.81
Pour pt, °C.: −3
Wax, wt %: 7.0
Carbon residue, wt %: 2.2
Asphaltenes, wt %: 0.2
V/Ni, ppm wt: 3/2
Watson K factor: 11.9
$C_1$-$C_4$, wt %: 2.74

**Gasoline**
Range (TBP), °C.: $C_5$-95
Yield, vol %: 9.23
Sulfur, wt %: <0.001
RON, clear: 69.5
RON + 0.44 ml TEL/l: 83
P/N/A, wt %: 71.1/25.7/3.2

**Naphtha**
Range, °C.: $C_5$-149
Yield, vol %: 20.02
Density @ 15° C., kg/l: 0.723
Sulfur, wt %: <0.001
RON, clear: 62
RON + 0.44 ml TEL/l: 77.5
P/N/A, wt %: 54.9/35.8/9.3

**Kerosine**
Range, °C.: 149-232
Yield, vol %: 14.50
Density @ 15° C., kg/l: 0.7995
Sulfur, wt %: 0.010
Aromatics, vol %: 19.5
Smoke pt, mm: 24
Cold test, °C.: −58
Aniline pt, °C.: 54
Diesel index: 59
Cetane index: 44

**Gas oil**
Range, °C.: 232-342
Yield, vol %: 20.92
Density @ 15° C., kg/l: 0.852
Sulfur, wt %: 0.14
Vis., cSt @ 37.8° C.: 3.5
@ 50° C.: 2.7
Cloud pt, °C.: −15
Pour pt, °C.: −15
Aniline pt, °C.: 67
Diesel index: 53
Cetane index: 52

**Residue**
Range, °C.: 342+
Yield, vol %: 40.96
Density @ 15° C., kg/l: 0.9265
Sulfur, wt %: 0.61
@ 50° C: 102
Pour pt, °C.: 33
Wax, wt %: 14.3
Carbon residue, wt %: 4.8
Asphaltenes, wt %: 0.5
V/Ni, ppm wt %: 7/4

**FCC feed**
Range, °C.: 369-509
Yield, vol %: 20.38
Density @ 15° C., kg/l: 0.9045
Sulfur, wt %: 0.44
Vis., cSt @ 37.8° C.: 45.6
Total nitrogen, ppm wt: 960
Aniline pt, °C.: 88

Note: Assay based on analyses of production crude samples obtained at rates of up to 400,000 b/d.

## Fulmar, U.K. North Sea

*SBM in producing area*

**Crude**
Gravity, °API: 39.3
Density @ 15° C., kg/l: 0.828
Sulfur, wt %: 0.26
Pour pt, °C.: −12
Kin. vis., @ 40° C., sq mm/sec: 2.55
Acid value, mg KOH/g (TAN): 0.06
Yield $C_4$−, vol %: 2.7

**Gasoline**
Range, °C.: $C_5$-85
Yield, vol %: 19.5
Density @ 15° C.: 0.666
RON, clear: 71
RON + 0.5 g Pb/l: 85

**Naphtha**
Range, °C.: 85-165
Yield, vol %: 19.5
Density @ 15° C.: 0.757
Sulfur, wt %: 0.001
Paraffins, wt %: 55
Naphthenes, wt %: 26
Aromatics: 19

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 15.7
Density @ 15° C.: 0.804
Sulfur, wt %: 0.02
Smoke pt: 23
Aromatics, vol %: 23

**Gas oil**
Range, °C.: 235-300
Yield, vol %: 12.2
Density @ 15° C.: 0.839
Sulfur, wt %: 0.06
Cetane index: 51.5

**Gas oil**
Range, °C.: 300-350
Yield, vol %: 9.5
Density @ 15° C.: 0.856
Sulfur, wt %: 0.26
Cetane index: 60
Cloud pt, °C.: +3
Kin. vis., @ 40° C., sq mm/sec: 5.70

**Residue**
Range, °C.: 350+
Yield, vol %: 33.1
Density @ 15° C.: 0.916
Sulfur, wt %: 0.56
Pour pt, °C.: +33
Kin. vis., @ 60° C.: sq mm/sec: 44.1
@ 100° C.: 11.3
Acid value: 0.08
Asphaltenes, wt %: 1.8
V/Ni, ppm: 5/1

Note: This has been designated a tentative assay.

## Gorm, Denmark North Sea

*SBM in producing area*

**Crude**
Gravity, °API: 33.9
Sulfur, wt %: 0.23
Vis., cSt @ 40° C.: 5.44
Pour pt, °F.: −35
$C_4$ & lighter, vol %: 1.6

**Light gasoline**
Range, °F: $C_5$-300
Yield, vol %: 19.7
Density, kg/l: 0.729
Sulfur, wt %: 0.001
P/N/A vol %: 53/40/7

**Naphtha**
Range, °F.: 300-400
Yield, vol %: 10.0
Density, kg/l 0.800
Sulfur, wt %: 0.026
Smoke pt, mm: 23
Freezing pt, °F.: < −94
Aniline pt, °F.: 120
P/N/A vol %: 32/47/21

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 12.1
Density, kg/l: 0.841
Sulfur, wt %: 0.065
Smoke pt, mm: 16
Freezing pt, °F.: −47
Cloud pt, °F.: −50
Pour pt, °F.: −60
Aniline pt, °F.: 134

**Diesel oil**
Range °F.: 500-650
Yield, vol %: 15.9
Density, kg/l: 0.865
Sulfur, wt %: 0.16
Cloud pt, °F.: 16
Pour pt, °F.: 20
Aniline pt., °F.: 155

**Gas oil**
Range, °F: 650-815
Yield, vol %: 15.0
Density, kg/l: 0.903
Sulfur, wt %: 0.30
Nitrogen, wt %: 0.08
Pour pt, °F.: 70
Aniline pt., °F.: 176
Vis., cSt @ 50° C.: 19.9

**Heavy gas oil**
Range, °F.: 815-1,000
Yield, vol %: 10.8
Density, kg/l: 0.924
Sulfur, wt %: 0.37
Nitrogen, wt %: 0.18
Pour pt, °F.: 100
Aniline pt, °F.: 196
Vis cSt @ 50° C.: 110

**Residuum**
Range, °F: 1,000+
Yield, vol %: 14.9
Density, kg/l: 0.972
Sulfur, wt %: 0.59
Nitrogen, wt %: 0.60
Hydrogen, wt %: 11.2
Carbon residue, wt %: 9.6
Vis., cSt @ 100° C.: 300
V/Ni, ppm: 65/40

Note: Subsequent to this assay Gorm has been joined by crude from Dan field (13% of blend in late 1982) and Skjold field (6% of blend). Skjold is marginal field. Dan has gravity of 30.4° API & sulfur content of 0.34 wt %.

## Gullfaks, Norway North Sea

*Block 34/10—Not yet in production*

**Crude**
Gravity, °API: 28.6
Sp gr, 60/60: 0.8838
Sulfur, wt %: 0.44
Pour pt, °F.: −50
Vis., cSt @ 100° F.: 10.14

**Gasoline**
Range, °C.: 20-70
Yield, wt %: 0.8
Sp gr, 60/60: 0.6948
Sulfur, wt ppm: 100
RON, clear: 82.9

Paraffins, wt %: 66
Naphthenes, wt %: 32.1
Aromatics, wt %: 1.9

**Gasoline**
Range, °C.: 70-100
Yield, wt %: 2.6
Sp gr, 60/60: 0.7433
Sulfur, wt ppm: 500
P/N/A, wt %: 34.8/58.3/6.9

**Gasoline**
Range, °C.: 100-150
Yield, wt %: 7.0
Sp gr, 60/60: 0.7808
Sulfur, wt %: 0.0023
P/N/A, wt %: 33/44.6/22.4
Yield, wt %: 7.0

**Gasoline**
Range °C.: 150-190
Yield, wt %: 6.6
Sp gr, 60/60: 0.8056
Sulfur, wt %: 0.0116
P/N/A, wt %: 42.5/32.3/25.2

**Kerosine**
Range, °C.: 150-205
Yield, wt %: 9.2
Sp gr, 60/60: 0.8108
Sulfur, wt %: 0.0148
Smoke pt, mm: 20
Diesel index: 48
Vis., cSt @ 100° F.: 1.03

**Gas oil**
Range, °C.: 205-343
Yield, wt %: 28.4
Sp gr, 60/60: 0.8676
Sulfur, wt %: 0.1935
Diesel index: 43
Vis., cSt @ 100° F.: 3.61

**Residue**
Range, °C.: 343+
Yield, wt %: 51.8
Gravity, °API: 19.3
Sp gr, 60/60: 0.9382
Sulfur, wt %: 0.77
Con. carbon, wt %: 3.8
Vis., cSt @ 100° F.: 351
Pour pt, °F.: 15

Note: This is a preliminary assay.

## Magnus, U.K. North Sea

### *Ninian system to Sullom Voe (hookup slated mid 1983)*

**Crude**
Gravity, °API: 39.3
Sulfur, wt %: 0.28
Pour pt, °C.: −3
Vis., cSt @ 21.1 °C.: 4.56
Carbon residue, wt %: 1.6
V/Ni, ppm wt %: 4/<2
Total $C_1$-$C_4$, wt %: 3.15

**Gasoline**
Range (TBP),°C.: $C_5$-95
Yield, wt %: 9.8

**Naphtha**
Range, °C.: 95-175
Yield, wt %: 16.75
P/N/A, wt %: 39.2/41.3/19.5

**Naphtha**
Range, °C.: $C_5$-149
Yield, wt %/vol %: 21.45/24.25
Density @ 15° C., kg/l: 0.733
Sulfur, wt %: 0.0015
P/N/A, wt %: 52.9/33.8/13.3

**Kerosine**
Range, °C.: 149-232
Yield, wt %/vol %: 15.0/15.5
Density @ 15 °C., kg/l: 0.8015
Sulfur, wt %: 0.0085
Acidity, mg KOH/g: 0.03
Aromatics, vol %: 19.9
Cold test, °C.: −53.5
Aniline pt, °C.: 54.2
Cetane index: 44

**Gas oil**
Range, °C.: 232-342
Yield, wt %/vol %: 21.4/20.9
Density @ 15° C., kg/l: 0.8485
Sulfur, wt %: 0.15
Pour pt, °C.: −15
Acidity, mg KOH/g: 0.05
Aniline pt, °C.: 68.0
Diesel index: 54
Cetane index: 53

**Gas oil**
Range, °C.: 342-369
Yield, wt %/vol %: 4.4/4.15
Density @ 15° C., kg/l: 0.8755
Sulfur, wt %: 0.39
Vis., cSt @ 50° C.: 6.85
Pour pt, °C.: 12
Aniline pt, °C.: 77.1
Diesel index: 51
Cetane index: 58

**Gas oil**
Range, °C.: 369-509
Yield, wt %/vol %: 21.15/19.45
Density @ 15° C., kg/l: 0.8995
Sulfur, wt %: 0.43
Vis., cSt @ 98.9° C.: 6.27
Wax, wt %: 17.5
Aniline pt, °C.: 89.1

**Residue**
Range, °C.: 342+
Yield, wt %/vol %: 39.0/35.15
Density @ 15° C., kg/l: 0.918
Sulfur, wt %: 0.57
Vis., cSt @ 50° C.: 69
Carbon residue, wt %: 4.5
Asphaltenes, wt %: 0.35
V/Ni, ppm wt: 11/4

**Residue**
Range, °C.: 509+
Yield, wt %/vol %: 13.45/11.55
Density @ 15° C., kg/l: 0.965
Sulfur, wt %: 0.80
Vis., cSt @ 98.9 °C.: 122
Carbon residue, wt %: 12.0
V/Ni, ppm wt %: 30/7

Note: Preliminary guide to Magnus, which was not in production when assay sample obtained.

## Maureen, U.K. North Sea

### *Not yet in production. Production expected late 1983 or early 1984.*

**Crude**
Gravity, °API @ 60° F.: 35.8/35.3*
Sulfur, wt %: 0.55
Pour test, °F.: +45
Vis., SUS @ 70° F.: 78.92/81.79*
$C_4$−, vol %: 2.6

**Gasoline**
Range, °F.: 60-200
Yield, vol %: 9.0
Sulfur, wt %: 0.002
RON, clear: 72.5
RON + 3 ml TEL/gal: 91.3

**Naphtha**
Range, °F.: 60-400
Yield, vol %: 27.9
P/N/A, vol %: 57.32/31.96/10.72
Sulfur, wt %: 0.002
RON, clear: 52.8
RON + 3 ml TEL/gal: 77.8

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 12.3
Gravity, °API: 39.7
Vis., SUS @ 100° F.: 32.15
Freeze pt, °F: −42
P/N/A, vol %: 37.8/40.1/22.1
Sulfur, wt %: 0.05
Aniline pt, °F.: 141.0
Smoke pt, mm: 20

**Gas oil**
Range, °F.: 500-650
Yield, vol %: 15.6
Gravity, °API: 34.0
Vis., SUS @ 100° F.: 42.34
Pour pt, °F.: +20
P/N/A, vol %: 34.3/39.8/25.9
Sulfur, wt %: 0.17
Aniline pt, °F.: 163.3
Cetane index: 55.5

**Topped crude**
Range, °F.: 650+
Yield, vol %: 41.6
Gravity, °API: 19.8
Vis., SUS @ 210° F.: 101.05
Pour pt, °F.: +90
Sulfur, wt %: 0.64
Rams. car. residue, wt %: 5.07
V/Ni, ppm 9.5/4.5

Note: The inspection of fractions is based on composite of three drillstem test samples.
* Results from two samples.

## Montrose, U.K. North Sea

### *SBM in producing area*

**Crude**
Gravity, °API: 40.1
Sulfur, wt %: 0.23
Rvp, psi: 4.0
Pour pt, °F.: 15
Neut. no., mg KOH/g: 0.28
Rams. carbon, wt %: 1.3
Vis kin., cSt @ 68° F.: 4.96
@ 100° F.: 3.27
V/Ni, ppm: 2/2
$C_4$−, vol %: 2.2

**Gasoline**
Range (TBP), °F.: $C_5$-200
Yield, vol %: 12.3
Sulfur, wt %: 0.002
P/N/A, vol %: 70.0/27.1/2.9
RON, clear: 71.4
RON + 3 cc TEL/gal: 89.5

**Naphtha**
Range, °F.: 200-320
Yield, vol %: 15.0
Gravity, °API: 55.5
Sulfur, wt %: 0.001
Charac. factor: 11.84
P/N/A vol %: 56.2/33.5/10.3
RON, clear: 42.8
RON + 3 cc TEL/gal: 68.0

**Kerosine**
Range, °F.: 320-400
Yield, vol %: 8.9
Gravity, °API: 47.7
Sulfur, wt %: 0.005
Aniline pt, °F.: 137.7
Diesel index: 65.7

Cetane index: 45.1
Freeze pt, °F.: −75
Smoke pt, mm: 24

**Gas oil**
Range, °F.: 400-650
Yield, vol %: 25.4
Gravity, °API: 38.2
Sulfur, wt %: 0.082
Aniline pt, °F.: 161.1
Diesel index: 61.6
Cetane index: 55.1
Cloud pt, °F.: 10
Pour pt, °F.: 4
Vis., SUS @ 100° F.: 35.2
Total nitrogen, wt %: 0.009

**Residue**
Range, °F.: 650+
Yield, vol %: 36.6
Gravity, °API: 23.7
Sulfur, wt %: 0.5
Pour pt, °F.: 80
Total nitrogen, wt %: 0.136
Rams. carbon, wt %: 3.3
Vis., SUS @ 122° F.: 334.6
@ 210° F.: 67.1
V/Ni, ppm: 4/4

## Murchison, U.K. & Norway, North Sea

*Brent system to Sullom Voe terminal*

**Crude**
Gravity, °API: 38.0
Kin. vis., @ 100° F.: 3.60
Con. carbon residue, wt %: 1.1
Sulfur, wt %: 0.27
V/Ni, ppm: 2.5/0.7
Pour pt, °C.: +7.2
Rvp, psi: 9.0
$C_4$ & lighter, vol %: 3.0

**Naphtha**
Range (TBP), °F.: 86-375
Yield, vol %: 31.2
Paraffins, vol %: 55.5
Naphthenes, vol %: 32.8
Sulfur, wt %: <0.01

**Kerosine**
Range, °F.: 375-520
Yield, vol %: 13.5
Gravity, °API: 42.2
Sulfur, wt %: 0.02
Aromatics, vol %: 17

**Heavy distillate**
Range, °F.: 520-700
Yield, vol %: 21.4
Gravity, °API: 34.1
Sulfur, wt %: 0.16

**Gas oil**
Range, °F.: 700-1,020
Yield, vol %: 21.0
Gravity, °API: 25.8
Sulfur, wt %: 0.43

**Residue**
Range, °F.: 1,020+
Yield, vol %: 11.9
Gravity, °API: 13.7
Sulfur, wt %: 0.93
Kin. vis. @ 210° F.: 196
Con. carbon residue, wt %: 11.8
V/Ni, ppm: 18/5

## Ninian Blend, U.K. North Sea

*Ninian system to Sullom Voe terminal*

**Crude**
Gravity °API: 35.6
Sulfur, wt %: 0.43
Vis., cSt @ 40° C.: 5.61
Pour pt, °F.: 35
$C_4$ & lighter, vol %: 2.6

**Light gasoline**
Range, °F.: $C_5$-300
Yield, vol %: 19.9
Density, kg/l: 0.726
Sulfur, wt %: 0.001
Paraffins, vol %: 63
Naphthenes, vol %: 27
Aromatics, vol %: 10

**Naphtha**
Range, °F.: 300-400
Yield, vol %: 9.3
Density kg/l: 0.788
Sulfur, wt %: 0.006
Smoke pt, mm: 27
Aniline pt, °F.: 128
P/N/A, vol %: 44/40/16

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 11.1
Density, kg/l: 0.828
Sulfur, wt %: 0.047
Smoke pt, mm: 21
Freeze pt, °F.: −33
Cloud pt, °F.: −40
Pour pt, °F.: −40
Aniline pt, °F.: 143

**Diesel oil**
Range, °F.: 500-650
Yield, vol %: 14
Density, kg/l: 0.852
Sulfur, wt %: 0.23
Cloud pt, °F.: 20
Pour pt, °F.: 20
Aniline pt, °F.: 164

**Gas oil**
Range, °F.: 650-815
Yield, vol %: 13.1
Density, kg/l: 0.883
Sulfur, wt %: 0.46
Nitrogen, wt %: 0.05
Pour pt, °F.: 75
Aniline pt, °F: 184
Vis., cSt @ 50° C.: 10.7

**Heavy gas oil**
Range, °F.: 815-1,000
Yield, vol %: 14.0
Density, kg/l: 0.906
Sulfur, wt %: 0.60
Nitrogen, wt %: 0.10
Pour pt, °F: 110
Aniline pt, °F: 205
Vis., cSt @ 50° C.: 71.3

**Residue**
Range, °F.: 1,000+
Yield, vol %: 16.0
Density, kg/l: 0.982
Sulfur, wt %: 1.2
Nitrogen, wt %: 0.40
Carbon residue, wt %: 11.7
Vis., cSt @ 100° C.: 291
V/Ni, ppm: 24/4

Note: This assay prepared when Heather field made up of 10% Ninian Blend. Magnus field is scheduled to contribute to Ninian system in mid 1983.

## Statfjord, Norway & UK, North Sea

*"A" and "B" SPM buoys in producing area*

**Crude**
Gravity, °API: 38.4
Pour pt, °F.: 40
Kin. vis., @ 59° F.: 7.33
Con. carbon residue, wt %: 1.32
Sulfur, wt %: 0.27
Rvp, psi: 5.5
Total nitrogen, ppm: 1.03
V/Ni, ppm: 0.53/1.03
$C_5$ & lighter, vol %: 5.08

**Naphtha**
Range (TBP), °F.: 60-100
Yield, vol %: 6.49
Sp gr, 60° F./60° F.: 0.6740
Rvp, psi: 10.3
Paraffins, vol %: 80.1
Naphthenes, vol %: 17.8
Aromatics, vol %: 2.1

**Naphtha**
Range, °F.: 100-360
Yield, vol %: 22.12
Sp gr 0.7603
P/N/A: 48.9/37.3/13.8
RON, clear: 51.3
RON +3 ml TEL: 74.2
Sulfur, wt %: 0.0037

**Kerosine**
Range, °F.: 360-503
Yield, vol %: 15.08
P/N/A, vol %: 48.1/34.6/17.2
Freeze pt, °F.: −47
Cloud pt, °F.: −52
Smoke pt, mm: 20
Aniline pt, °F: 142.1
Diesel index: 60
Cetane index: 49
Sulfur, wt %: 0.03

**Light gas oil**
Range, °F.: 503-710
Yield, vol %: 22.22
Sp gr, 60° F./60° F.: 0.8526
Gravity, °API: 34.5
Pour pt, °F.: 25
Aniline pt, °F.: 166

**Heavy gas oil**
Range, °F.: 710-946
Yield, vol %: 22.09
Gravity, °API: 25.6
Pour pt, °F.: 105
Kin. vis., cSt @ 100° F.: 66.27
Aniline pt, °F.: 200
Sulfur, wt %: 0.40
Basic nitrogen, ppm: 375
Con. carbon residue, wt %: 0.07

**Residue**
Range, °F.: 946+
Yield, vol %: 9.84
Gravity, °API: 14.2
Pour pt, °F.: 120
Kin. vis., cSt @ 100° F.: 24,732.61
Sulfur, wt %: 0.74
Total nitrogen, ppm: 1,750
Con. carbon, wt %: 10.58
V/Ni, ppm: 8.1/5.7

Note: This assay is on production from Statfjord "A" platform. Statfjord "B" began operation in November 1982.

## Tartan, U.K. North Sea

*Flotta system*

**Crude**
Gravity, °API: 41.7
Sulfur, wt %: 0.56
Vis., cSt @ 40° F.: 11.6
Pour pt, °F.: 16
$C_4$ & lighter, vol %: 3.5
Rvp @ 100° F., psi: 10.2

**Naphtha**
Range, °F.: $C_5$-149
Yield, vol %: 5.7
Sulfur, wt %: 0.001
Paraffins, vol %: 97.0
Naphthenes, vol %: 1.5
Aromatics, vol %: 1.0
RON, clear: 70.2

**Naphtha**
Range, °F.: 149-302
Yield, vol %: 20.0
Gravity, °API: 58.5
Sulfur, wt %: 0.01
P/N/A, vol %: 56.5/25.5/17.5
RON, clear: 56.6

**Naphtha**
Range, °F.: 302-356
Yield, vol %: 7.1
Gravity, °API: 49.4
Sulfur, wt %: 0.06
P/N/A, vol %: 50/30/19.5

**Kerosine**
Range, °F.: 356-455
Yield, vol %: 10.8
Gravity, °API: 44.0
Sulfur, wt %: 0.1
Aromatics, vol %: 23.5
Smoke pt, mm: 20
Freeze pt, °F.: −52
Aniline pt, °F.: 135

**Gas oil**
Range, °F.: 455-572
Yield, vol %: 12.3
Gravity, °API: 37.3
Sulfur, wt %: 0.32
Aromatics, vol %: 28.0
Aniline pt, °F.: 149

**Gas oil**
Range, °F.: 572-650
Yield, vol %: 8.3
Gravity, °API: 34.0
Sulfur, wt %: 0.64
Aromatics, vol %: 32.0
Aniline pt, °F.: 167

**Residue**
Range, °F.: 650+
Yield, vol %: 32.3
Gravity, °API: 23.1
Sulfur, wt %: 1.22
Vis., cSt @ 122° F.: 55.5
Con. carbon residue, wt %: 2.5
V/Ni/Fe, ppm: 6.0/2.0/4.0

Note: Tartan is part of Flotta Blend.

## Thistle, U.K. North Sea

*Brent system to Sullom Voe terminal*

**Crude**
Gravity, °API: 37.03
Vis., cSt @ 20° C.: 5.87
@ 37.8° C.: 4.26
Pour pt, °C.: 12
Rvp, psig: 7.5
$H_2S$, wt %: <0.01
Acid no., mg KOH/g: <0.05
Sulfur, wt %: 0.31
Wax, wt %: 7.7
Asphaltenes, wt %: 0.19
$C_4$—, wt % on crude (GLC): 0.69

**Gasoline**
Range, °C.: $C_5$-85
Yield, vol %/wt %: 7.0/5.6
Density @ 15° C., g/cc: 0.6771
Sulfur, wt %: <0.01
RON, clear/0.5 g TEL per liter: 71.6/84.7
PO/N/A, wt %: 64.0/Nil/25/11.0

**Naphtha**
Range, °C.: 85-165
Yield, vol %/wt %: 16.6/15.0
Density @ 15° C., g/cc: 0.7547
Sulfur, wt %: <0.01
P/O/N/A, wt %: 44.5/Nil/42.9/12.6

**Kerosine**
Range, °C.: 165-235
Yield, vol %/wt %: 12.6/11.9
Density @ 15° C., g/cc: 0.7984
Sulfur, wt %: 0.02
Smoke pt, mm: 24
Freeze pt, °C.: −51
Aniline pt, °C.: 58.7
Aromatics, vol %: 15.0

**Light gas oil**
Range, °C.: 235-300
Yield, vol %/wt %: 12.9/12.9
Density @ 15° C., g/cc: 0.8393
Sulfur, wt %: 0.06
Vis., cSt @ 37.8° C.: 2.46
Cetane index: 49.5
Pour pt, °C.: −24
Cloud pt, °C.: −22
Aniline pt, °C.: 65.9
Con. car. residue (on 10% residue), wt %: 0.004

**Heavy gas oil**
Range, °C.: 300-350
Yield, vol %/wt %: 9.6/9.8
Density @ 15° C., g/cc: 0.8494
Sulfur, wt %: 0.21
Vis., cSt @ 37.8° C.: 5.47
Cetane index: 58.5
Pour pt, °C.: 0
Cloud pt, °C.: 1
Aniline pt, °C.: 77.9
Con. car. residue (on 10% residue), wt %: 0.039

**Residue**
Range, °C.: 350+
Yield, vol %/wt %: 39.8/43.8
Density @ 15° C., g/cc: 0.9217
Sulfur, wt %: 0.63
Vis., cSt @ 98.9° C.: 14.77
Pour pt, °C.: 39
Asphaltenes, wt %: 0.95
Con. car. residue, wt %: 4.6
V/Ni, ppm: 7.5/1.9
-30

# West African

## Bonny Light, Nigeria

*Bonny shore terminal and Bonny marine SBM (12 miles offshore in Atlantic)*

**Crude**
Gravity, °API: 36.7
Sulfur, wt %: 0.12
Salt, lb/1,000 bbl: 12
Wax, wt %: 7.5
Carbon residue, wt %: 1.0
V/Ni, ppm wt: <2/3
Vis., cSt @ 37.8° C.: 3.47
Yield $C_1$—$C_4$, wt %: 2.10

**Naphtha**
Range (TBP), °C.: $C_5$—149
Yield, vol %: 20.85
Sulfur, wt %: 0.002
Watson K factor: 12.2
RON, clear: 68.5
RON + 0.44 ml TEL/l: 81.5
Paraffins, wt %: 42.6
Naphthenes, wt %: 47.6
Aromatics, wt %: 9.8

**Kerosine**
Range, °C.: 149—232
Yield, vol %: 16.8
Sulfur, wt %: 0.020
Aromatics, vol %: 17
Smoke pt, mm: 21
Freeze pt, °C.: −61
Aniline pt, °C.: 53
Diesel index: 54
Cetane index: 39

**Gas oil**
Range, °C.: 232—342
Yield, vol %: 27.1
Sulfur, wt %: 0.10
Cloud pt, °C.: −11
Pour pt, °C.: −12
Wax, wt %: 5.5
Aniline pt, °C.: 67
Diesel index: 51
Cetane index: 49

**Heavy gas oil**
Range, °C.: 369—509
Yield, vol %: 19.6
Sulfur, wt %: 0.22
Vis., cSt @ 37.8° C.: 56.4
Pour pt, °C.: 39
Wax, wt %: 26
Total nitrogen, ppm wt: 1,180
Watson K factor: 11.9
Aniline pt, °C.: 86

**Residue**
Range, °C.: 342+
Yield, vol %: 32.6
Sulfur, wt %: 0.25
Vis., cSt @ 3.78° C.: 115
Pour pt, °C.: 39
Wax, wt %: 22
Total nitrogen, wt %: 0.24
Carbon residue, wt %: 2.7
V/Ni, ppm wt: 1/9
Watson K factor: 11.85

Note: Numerous fields contribute to Bonny Light and Medium blends, whose qualities are also influenced by national output. Analysis is on sample taken during period of high production.

## Bonny Medium, Nigeria

*Bonny shore terminal and Bonny marine CALM (12 miles offshore in Atlantic)*

**Crude**
Gravity, °API: 25.2
Sulfur, wt %: 0.23
Vis., cSt @ 37.8 °C.: 12.1
Pour pt, °C.: −27
Carbon residue, wt %: 1.7
V/Ni, ppm wt: <1/7
$C_1$—$C_4$ yield, wt %: 0.52

**Naphtha**
Range (TBP), °C.: $C_5$—149
Yield, vol %: 6.31
Sulfur, wt %: 0.003
RON, clear: 73.5
RON + 0.44 ml TEL/l: 85.5
Paraffins, wt %: 32.8
Naphthenes, wt %: 54.7
Aromatics, wt %: 12.5

**Kerosine**
Range, °C.: 149—232
Yield, vol %: 12.85
Sulfur, wt %: 0.038
Aromatics, vol %: 16.5
Smoke pt, mm: 19
Freeze pt, °C.: < −70
Aniline pt, °C.: 49
Diesel index: 44
Cetane index: 32

**Gas oil**
Range, °C.: 232—343
Yield, vol %: 34.3
Density @ 15° C., kg/l: 0.889
Sulfur, wt %: 0.16
Vis., cSt @ 37.8 °C.: 4.7
Cloud pt, °C.: −32
Pour pt, °C.: −33
Aniline pt, °C.: 55
Diesel index: 36
Cetane index: 38

**Heavy gas oil**
Range, °C.: 369—509
Yield, vol %: 25.6
Density @ 15° C., kg/l: 0.9405
Sulfur, wt %: 0.31
Vis., cSt @ 37.8° C.: 162
Pour pt, °C.: 24
Total nitrogen, ppm wt: 1,790
Aniline pt, °C.: 72

**Residue**
Range, °C.: 342+
Yield, vol %: 45.95
Density @ 15° C., kg/l: 0.953
Sulfur, wt %: 0.37
Vis. @ 37.8 °C.: 515
Pour pt, °C.: 24
Carbon residue, wt %: 3.5
V/Ni, ppm wt: 2/15

Note: See note at end of Bonny Light assay.

## Brass River, Nigeria

*CALM some 12 miles off mouth of Brass*

**Crude**
Gravity, °API @ 60° F.: 40.9
Sulfur, wt %: 0.09
Pour test, °F.: +35
Vis., SUS @ 70° F.: 38.66
Rvp, psi @ 100° F.: 6.9
Salt, lb/1,000 bbl: 3.8
V/Ni, ppm: 2.0/1.7
$C_4$ & lighter yield, vol %: 1.9

**Gasoline**
Range, °F.: 60—200
Yield, vol %: 11.2
Total sulfur, wt %: 0.001
RON, clear: 74.6
RON + 3 ml TEL/gal: 92.2
Rvp, psi: 12.4

**Naphtha**
Range, °F.: 200—300
Yield, vol %: 16.6
Paraffins, vol %: 44.97
Naphthenes, vol %: 43.52
Aromatics, vol %: 11.51
Total sulfur, wt %: <0.001

**Naphtha**
Range, °F.: 300—400
Yield, vol %: 11.5
P/N/A, vol %: 45.78/38.45/15.77
Total sulfur, wt %: 0.0087
Aniline pt, °F.: 128.0
Smoke pt, mm: 26

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 16.9
Freezing pt, °F.: −36
P/N/A, vol %: 45.9/37.2/16.9
Total sulfur, wt %: <0.05
Aniline pt, °F.: 146.2
Smoke pt, mm: 20

**Gas oil**
Range, °F.: 500—650
Yield, vol %: 15.7
Gravity, °API: 33.9
Vis., SUS @ 100° F.: 41.41
Pour pt, °F.: +30
P/N/A, vol %: 47.0/32.1/20.9
Total sulfur, wt %: 0.06
Aniline pt, °F.: 167.2
Cetane index (determined): 57.4

**Residue**
Range, °F.: 650+
Yield, vol %: 26.5
Vis., SUS @ 210° F.: 53.55
Pour pt, °F.: +105
Total sulfur, wt %: 0.14
Rams. carbon residue, wt %: 2.31
V/Ni/Fe, ppm: 6.6/5.7/5.8

**Heavy gas oil**
Range (vac. flash), °F.: 625—1,100
Yield, vol %: 24.7
Aniline pt, F.: 190.1
Vis., SUS @ 130° F.: 127.55
Pour pt, °F.: +105
Sulfur, wt %: 0.33
Rams. carbon res., wt %: 0 67
V/Ni/Fe, ppm: 0.2/1.2/<0.2
Nitrogen, wt %: 0 139

## Cabinda, Angola

*CALM in producing area off Malongo terminal, Cabinda*

**Crude**
Gravity, °API: 31.7
Sulfur, wt %: 0.17
Vis., SUS @ 100° F.: 93.5
Pour pt, °F.: +65
$C_4$ & lighter, vol %: 1.58
Rvp, psi: 3.8
V/Ni, ppm: 2.4/15.9
Salt, lb/1,000 bbl: 18
ASTM, 50% pt, °F.: >590

**Light naphtha**
Range (TBP), °F.: Ibp—140°
Yield, vol %: 2.18
Sulfur, wt %: 0.024
RON, clear: 77.3

**Light naphtha**
Range, °F.: 140—170
Yield, vol %: 1.67
Sulfur, wt %: 0.018
Paraffins, vol %: 77.6
Naphthenes, vol %: 21.4
Aromatics, vol %: 1.0
RON, clear: 65.1

**Heavy naphtha**
Range, °F.: 170—310
Yield, vol %: 9.98
Sulfur, wt %: 0.06
P/N/A, vol %: 50.0/44.8/5.2
Aniline pt, °F.: 134.4

**Kerosine**
Range, °F.: 310—520
Yield, vol %: 16.27
Gravity, °API: 43.7
Sulfur, wt %: 0.08
Freezing pt, °F.: −42
Aniline pt, °F.: 148.5
Cetane index: 50.8
Smoke pt, mm: 25

**Light gas oil**
Range, °F.: 520—680
Yield, vol %: 15.83
Gravity, °API: 34.9
Vis., SUS @ 100° F.: 44.4
Sulfur, wt %: 0.14
Pour pt, °F.: +35
Diesel index: 61.2
Cetane index: 60.5

**Heavy gas oil**
Range (TBP to EFV), °F.: 680—1,000
Yield, vol %: 29.34
Gravity, °API: 25.8
Vis., SUS @ 210° F.: 55.6
Sulfur, wt %: 0.16
Total nitrogen, ppm: 1,400
Pour pt, °F.: +115
Aniline pt, °F.: 210.2
V/Ni, ppm: >0.1/0.4

**Residual oil**
Range, °F.: 680+
Yield, vol %: 52.87
Gravity, °API: 20.4
Vis., SUS @ 210° F.: 210
Sulfur, wt %: 0.24
Con. carbon res., wt %: 5.82
Pour pt, °F.: +95
V/Ni, ppm: 4.2/28

*Does not include $C_4$ and lighter

## Djeno Blend, Congo (Brazzaville)

*CALM located 3.8 km from Djeno tank farm*

**Crude**
Gravity, °API: 26.87
Vis., cSt @ 10° C.: 220
Pour pt, °C.: +3
Rvp @ 37.8° C., g/sq cm: 290
Total sulfur, wt %: 0.33
Acidity, mg KOH/g: 1.10
UOP charac. factor: 12.0
V/Ni, kg/mg: <1/23
Yield $C_1$—$C_5$, vol %: 2.37

**Gasoline**
Range, °C.: 15—80
Yield, vol %: 2.59
RON, clear: 69.0
Sulfur, wt %: 0.0876
Aromatics, vol %: 1.3

**Naphtha**
Range, °C.: 80—180
Yield, vol %: 11.86
Paraffins, vol %: 52.5
Naphthenes, vol %: 39.8
Aromatics, vol %: 7.7
Sulfur, wt %: 0.16

**Kerosine**
Range, °C.: 180—225
Yield, vol %: 5.90
Freezing pt, °C.: −51
Smoke pt, mm: 20
Sulfur, wt %: 0.20
Aromatics, vol %: 12.5

**Gas oil**
Range, °C.: 225—350
Yield, vol %: 21.88
Pour pt, °C.: −10
Cloud pt, °C.: −7
Sulfur, wt %: 0.17

**Heavy gas oil**
Range, °C.: 400—550
Yield, vol %: 21.88
Density 15/4 °C.: 0.926
Pour pt, °C.: +39
Vis., cSt @ 50° C.: 185
V/Ni, ppm: <0.5/<1
Sulfur, wt %: 0.25
Nitrogen, pm: 944
Aniline pt, °C.: 95.7
Con. carbon residue, wt %: 0.60

**Residue**
Range, °C.: 350+
Yield, vol %: 57.42
Density, 15/4 °C.: 0.952
Pour pt, °C.: +30
Vis., cSt @ 50° C.: 1,850
Sulfur, wt %: 0.41

## Escravos, Nigeria

*CALM in offshore producing area*

**Crude**
Gravity, °API: 36.2
Sulfur, wt %: 0.14
Vis., SUS @ 100° F.: 37.6
Pour pt, °F.: +10
$C_4$ & lighter, vol %: 2.24
Rvp, lb: 4.3
V/Ni, ppm: 0.3/3.8
Salt, lb/1,000 bbl: 1
Uncondensed gases, vol %: 1.95

**Light naphtha**
Range (TBP), °F.: Ibp—140
Yield, vol %: 2.82
Gravity, °API: 88.0
Sulfur, wt %: 0.015
RON, clear: 82.6

**Light naphtha**
Range (TBP), °F.: 140—170
Yield, vol %: 1.60
Gravity, °API: 74.5
Sulfur, wt %: 0.009
P/N/A, vol %: 72.0/24.6/3.4
RON, clear: 75.0

**Heavy naphtha**
Range (TBP), °F.: 170—310
Yield, vol %: 16.13
Gravity, °API: 55.6
Sulfur, wt %: 0.013
P/N/A, vol %: 41.6/46.5/11.9
Aniline pt, °F.: 113.9

**Kerosine**
Range (TBP), °F.: 310—520
Yield, vol %: 28.55
Gravity, °API: 39.5
Sulfur, wt %: 0.06
Freezing pt, °F.: −51
Aniline pt, °F.: 131.4
Cetane index: 38.5
Smoke pt (ASTM), mm: 15

**Light gas oil**
Range (TBP), °F.: 520—680
Yield, vol %: 19.17
Gravity, °API: 31.1
Vis., SUS @ 100° F.: 44.9
Sulfur, wt %: 0.19
Pour pt, °F.: +30
Diesel index: 49.9
Cetane index: 47.0

**Heavy gas oil**
Range (TBP or EFV), °F.: 680—1,000
Yield, vol %: 23.76
Gravity, °API: 22.4
Vis., SUS @ 210° F.: 56.1
Sulfur, wt %: 0.22
Nitrogen (total), ppm: 1,700
Pour pt, °F.: +120
Aniline pt, °F.: 190.0
V/Ni, ppm: >0.1/0.9

**Residual oil**
Range (TBP or EFV), °F.: 680+
Yield, vol %: 29.78
Gravity, °API: 19.9
Vis., SUS @ 210° F.: 93.5
Sulfur, wt %: 0.27
Con. carbon residue, wt %: 3.72
Pour pt, °F.: +115
V/Ni, ppm: 1.0/11.5

## Espoir, Ivory Coast

*CALM yoke with permanent floating storage in producing area*

**Crude**
Gravity, °API: 31.4
Sp gr @ 60° F.: 0.8686
Sulfur, wt %: 0.32
Pour test, °F.: +5
Vis., SUS @ 70° F.: 69.78
Rvp @ 100° F., psi: 5.5
Salt lb/1,000 bbl: 15.0
Yield, $NC_4$ & lighter, vol %: 0.8
V/Ni, ppm: 1.7/5.8

**Gasoline**
Range, °F.: 60—200
Yield, vol %: 4.5
Total sulfur, wt %: <0.001
RON, clear (calc.): 73.6

**Naphtha**
Range, °F.: 200—300
Yield, vol %: 10.9
Total sulfur, wt %: 0.0049
Aniline pt, °F.: 118.5

**Naphtha**
Range, °F.: 300—400
Yield, vol %: 9.4
Paraffins, vol %: 43.42
Naphthenes, vol %: 48.19
Aromatics, vol %: 8.39
Total sulfur, wt %: 0.036
Aniline pt, °F.: 121.5
Smoke pt, mm: 25

**Kerosine**
Range, °F.: 400—500
Gravity, °API: 36.1
Vis., SUS @ 100° F.: 32.84
Freezing pt, °F.: −56
P/N/A, vol %: 26.3/50.9/22.8
Sulfur, wt %: 0.07
Aniline pt, °F.: 136.1
Smoke pt, mm: 19

**Light gas oil**
Range, °F.: 500—650
Yield, vol %: 17.1
Gravity, °API: 30.7
Vis., SUS @ 100° F.: 45.28
Pour pt, °F.: +10
P/N/A, vol %: 28.3/49.8/21.9
Total sulfur, wt %: 0.22
Aniline pt, °F.: 157.4

**Vacuum gas oil**
Range, °F.: 620—1,000
Yield, vol %: 25.7
Gravity, °API: 23.3
Aniline pt, °F.: 192.1
Vis., SUS @ 130° F.: 152.01
Pour pt, °F.: +90
Sulfur, wt %: 0.39
Rams. carbon res., wt %: 0.15
V/Ni, ppm: 0.1/0.2
Nitrogen, wt %: 0.086

**Residue**
Range, °F.: 650+
Yield, vol %: 42.9
Vis., SUS @ 210° F.: 125.43
Pour pt, °F.: +80
Total sulfur, wt %: 0.565
Rams. carbon res., wt %: 3.69
Nitrogen, wt %: 0.225
V/Ni, ppm: 3.8/12.6

## Forcados Blend, Nigeria

*CALMS some 7 miles off coast*

**Crude**
Gravity, °API: 29.7
Sulfur, wt %: 0.29
Pour pt, °C.: −20
Kin. vis., cSt @ 10° C.: 10.6
$C_4$ & lighter: 0.7

**Light naphtha**
Range, °C.: $C_5$—65
Yield, wt %: 1.4
Density @ 15° C., g/cu cm: 0.650
RON + 0.4 g Pb/l: 87.5

**Heavy naphtha**
Range, °C.: 65—175
Yield, wt %: 12.3
Density @ 15° C., g/cu cm: 0.765
RON + 0.4 g Pb/l: 75
Aromatics, vol %: 12.0
Naphthenes, vol %: 53

**Kerosine**
Range, °C.: 175—225
Yield, wt %: 9.0
Density @ 15° C., g/cu cm: 0.830
Sulfur, wt %: 0.04

**Gas oil**
Range, °C.: 225—360
Yield, wt %: 37.8
Density @ 15° C., g/cu cm: 0.880
Sulfur, wt %: 0.18
Pour pt, °C.: −17
Cold filter pour pt, °C.: −15
Kin. vis., cSt @ 100° C.: 1.46

**Heavy gas oil**
Range, °C.: 360—525
Yield, wt %: 28.6
Density @ 15° C.: 0.941
Sulfur, wt %: 0.40
Kin. vis., cSt @ 100° C.: 10.6

**Residue**
Range, °C.: 360+
Yield, wt %: 38.8
Density @ 15° C.: 0.953
Sulfur, wt %: 0.56
Kin. vis., cSt @ 100° C.: 22.1

## Gamba, Gabon

*Buoy 6 km offshore from Gamba tank farm*

**Crude**
Gravity, °API: 31.8
Vis., cSt @ 37.8° C.: 36.7
Pour pt, °C.: +23
Total sulfur, wt %: 0.11
Con. carbon, wt %: 3.10
UOP charac. factor: 12.20
Yield $C_1$—$C_5$, vol %: 1.42

**Gasoline**
Range, °C.: $C_5$—80
Yield, vol %: 1.3
Rvp, psi, g/sq cm: 800
RON, clear: 90
Sulfur, wt %: 0.0036

**Heavy naphtha**
Range, °C.: 80—160
Yield, vol %: 4.9
Density @ 15/4 °C.: 0.753
Paraffins, vol %: 46.9
Naphthenes, vol %: 50.6
Aromatics, vol %: 2.5
Sulfur, wt %: 0.0069

**Kerosine**
Range, °C.: 160—250
Yield, vol %: 11.8
Density @ 15/4 °C.: 0.808
Freezing pt, °C.: −52
Smoke pt, mm: 23
Sulfur, wt %: 0.014
Aniline pt, °C.: 64.2
Aromatics, vol %: 14.0

**Gas oil**
Range, °C.: 250—350
Yield, vol %: 19.3
Density @ 15/4 °C.: 0.838
Pour pt, °C.: −14
Cloud pt, °C.: −11
Vis., °Engler @ 20° C.: 1.58
Cetane index: 53
Sulfur, wt %: 0.057
Diesel index: 66
Aniline pt, °C.: 80.4

**Residue**
Range, °C.: +350
Yield, vol %: 62.0
Density @ 15/4 °C.: 0.900
Pour pt., °C.: +45
Vis., °Engler @ 50° C.: 18.9
Sulfur, wt %: 0.16

## Kole Marine Blend, Cameroon

*CALM with floating storage in offshore producing area*

**Crude**
Gravity, °API: 34.89
Vis., cSt @ 10° C.: 11.1
Pour pt, °C.: −6
Total sulfur, wt %: 0.30
Rvp @ 37.8° C., g/sq cm: 445
Paraffins, wt %: 6.2
Con. carbon, wt %: 3.65
UOP charac. factor: 11.9
V/Ni, kg/mg: 9/27
$C_1$—$C_5$, yield, vol %: 6.12

**Light gasoline**
Range, °C.: 15—80
Yield, vol %: 5.71
RON, clear: 76.2

**Heavy naphtha**
Range, °C.: 80—180
Yield, vol %: 21.89
Density, 15/4 °C.: 0.765
Paraffins, vol %: 38.5
Naphthenes, vol %: 53.3
Aromatics, vol %: 8.2
Sulfur, wt %: 0.0080

**Kerosine**
Range, °C.: 180—225
Yield, vol %: 8.21
Density @ 15/4 °C.: 0.819
Freeze pt, °C.: −63
Smoke pt, mm: 20
Sulfur, wt %: 0.0467
Aromatics, vol %: 13.4

**Gas oil**
Range, °C.: 150—400
Yield, vol %: 43.89
Density @ 15/4 °C.: 0.839
Pour pt, °C.: −9
Vis., cSt @ 50° C.: 2.6
Cetane index: 52.0
Sulfur, wt %: 0.16

**Gas oil**
Range, °C.: 180—350
Yield, vol %: 30.46
Density @ 15/4 °C.: 0.838
Pour pt, °C.: −22
Sulfur, wt %: 0.15

**Residue**
Range, °C.: 350+
Yield, vol %: 38.91
Density @ 15/4 °C.: 0.947
V/Ni, ppm: 20/68
Pour pt, °C.: +33
Vis. @ 50° C.: 425
Ash, wt %: 0.05
Sulfur, wt %: 0.54

## Lucina Marine, Gabon

*CALM with floating storage in offshore producing area*

**Crude**
Gravity, °API: 39.52
Vis., cSt @ 20° C.: 16.00
Pour pt, °C.: +15
Rvp @ 37.8° C., g/sq cm: 450
Total sulfur, wt %: 0.05
Asphaltenes, wt %: 0.06
UOP charac. factor: 12.25
V/Ni, kg/mg: 1.3/12.2

**Gasoline**
Range, °C.: $C_5$—80
Yield, vol %: 5.56
Rvp, g/sq cm: 698
RON, clear: 66.3

**Heavy gasoline**
Range, °C.: 80—150
Yield, vol %: 13.46
Paraffins, vol %: 54.3
Naphthenes, vol %: 37.8
Aromatics, vol %: 7.9
Sulfur, wt %: 0.005

**Kerosine**
Range, °C.: 150—225
Yield, vol %: 14.38
Density @ 15/4 °C.: 0.778
Freeze pt, °C.: −55
Vis., cSt @ 34.4° C.: 5.07
Smoke pt, mm: 21
Sulfur, wt %: 0.006
Aromatics, vol %: 10.6

**Gas oil**
Range, °C.: 150—350
Yield, vol %: 38.59
Density @ 15/4 °C.: 0.809
Pour pt, °C.: −18
Vis., °Engler @ 50° C.: 1.78
Cetane index: 60.0
Diesel index: 71.8
Sulfur, wt %: 0.010
Aniline pt, °C.: 74.2

**Residue**
Range, °C.: 350+
Yield, vol %: 40.23
Density @ 15/4 °C.: 0.898
Pour pt, °C.: +36
Vis., cSt @ 50° C.: 86.4
Sulfur, wt %: 0.060
Asphaltenes, wt %: 0.08
Con. carbon, wt %: 2.96
V, ppm: 3

## Mandji, Gabon

*Cap Lopez terminal, loading berth, Prince's Bay*

**Crude**
Gravity, °API: 30.5
Vis., cSt @ 10° C.,: 44.0
Pour pt, °C.: +3
Rvp @ 37.8° C., g/sq cm: 270
Total sulfur, wt %: 1.10
Asphaltenes, wt %: 0.3
Con. carbon, wt %: 5.40
UOP charac. factor: 12.1
V/Ni, kg/mg: 48/50
$C_1$—$C_5$, yield, vol %: 4.46

**Gasoline**
Range, °C.: 15—80
Yield, vol %: 5.38
RON, clear: 74.2

**Heavy naphtha**
Range, °C.: 80—150
Yield, vol %: 9.63
Paraffins, vol %: 55.2
Naphthenes, vol %: 36.7
Aromatics, vol %: 8.1
Sulfur, wt %: 0.006

**Kerosine**
Range, °C.: 150—225
Yield, vol %: 10.37
Density @ 15/4 °C.: 0.795
Freeze pt, °C.: −53
Smoke pt, mm: 24
Sulfur, wt %: 0.101
Aromatics, vol %: 17.3
Aniline pt, °C.: 56.1

**Gas oil**
Range, °C.: 150—375
Yield, vol %: 36.12
Density @ 15/4 °C.: 0.839
Pour pt, °C.: −15
Vis., cSt @ 50° C.: 2.28
Cetane index: 55.1
Diesel index: 59.7
Sulfur, wt %: 0.4
Aniline pt, °C.: 69.3

**Heavy gas oil**
Range, °C.: 375—525
Yield, vol %: 23.10
Density @ 15/4 °C.: 0.909
Pour pt, °C.: +37
Vis., cSt @ 50° C.: 50
Nitrogen, ppm: 480
Aniline pt, °C.: 85.4
Ni, ppm: <1
Sulfur, wt %: 1.14
Con. carbon, wt %: 0.45

**Residue**
Range, °C.: 375+
Yield, vol %: 46.96
Density @ 15/4 °C.: 0.952
V/Ni, ppm: 93/98
Pour pt, °C.: +36
Vis., cSt @ 50° C.: 2,100
Sulfur, wt %: 1.81
Asphaltenes, wt %: 0.49
Con. carbon, wt %: 10.2

## Pennington, Nigeria

*CALM with export from floating storage in offshore producing area*

**Crude**
Gravity, °API: 36.6
Sulfur, wt %: 0.07

Vis., cSt @ 104° F.: 3.06
Pour pt, °F.: 43
$C_4$ & lighter, vol %: 1.5
Rvp @ 100° F., psi: 5.1
Con. carbon residue, wt %: 0.7
V/Ni, ppm: 2/1

**Light naphtha**
Range, °F.: $C_5$—200
Yield, vol %: 7.4
Sulfur, wt %: 0.001
Paraffins, vol %: 70.5
Naphthenes, vol %: 25.5
Aromatics, vol %: 3.5
RON, clear: 74.9

**Heavy naphtha**
Range, °F.: 200—340
Yield, vol %: 14.7
Sulfur, wt %: 0.001
P/N/A, vol %: 35.0/52.5/12.0
RON, clear: 55.5
Aniline pt, °F.: 118

**Kerosine**
Range, °F.: 340—470
Yield, vol %: 18.0
Gravity, °API: 40.6
Sulfur, wt %: 0.02
Vis., cSt @ 104° F.: 1.45
Smoke pt, mm: 19.5
Freeze pt, °F.: −69
Aniline pt, °F.: 135
Cloud pt, °F. < −76

**Gas oil**
Range, °F.: 470—650
Yield, vol %: 31.7
Gravity, °API: 33.7
Sulfur, wt %: 0.05
Vis., cSt @ 104° F.: 3.72
Pour pt, °F. −1.0
Aniline pt, °F.: 158
Cloud pt, °F.: 6.0

**Vacuum gas oil**
Range, °F.: 650—1,000
Yield, vol %: 23.4
Gravity, °API: 23.5
Sulfur, wt %: 0.15
Vis., cSt @ 122° F.: 28.9
Pour pt, °F.: 102
Aniline pt, °F.: 184
Con. carbon residue, wt %: 0.12
V/Ni, ppm: 2/<1

**Residue**
Range, °F.: 650+
Yield, vol %: 26.7
Gravity, °API: 21.8
Sulfur, wt %: 0.17
Vis., cSt @ 122° F.: 48.5
Pour pt, °F.: 91
Aniline pt, °F.: 179
Con. carbon residue, wt %: 2.3

## Qua Iboe, Nigeria

*CALM in offshore producing area*

**Crude**
Gravity, °API: 35.8
Pour pt, °F.: 45
Kin. vis., cSt @ 59° F.: 6.76
  @ 104° F.: 3.39
Con. carbon residue, wt %: 0.92
Aniline pt, °C.: 62.56
Sulfur, wt %: 0.12
Rvp, psi: 6.0
Nitrogen, total, ppm: 540
V/Ni, ppm: 0.3/3.3
$C_5$ & lighter, yield, vol %: 5.13

**Light naphtha**
Range (TBP), °F.: 60—180
Yield, vol %: 5.15
Rvp, psi: 10.3
Paraffins, vol %: 67.3
Naphthenes, vol %: 31.6
Aromatics, vol %: 1.1
Sulfur, wt %: 0.0008

**Heavy naphtha**
Range, °F.: 180—380
Yield, vol %: 25.14
Rvp, psi: 1.0
P/N/A, vol %: 34.6/55.3/10.1
RON, clear: 56.6
RON + 3 ml TEL/gal: 76.0
Sulfur, wt %: 0.026

**Kerosine**
Range, °F.: 330—444
Yield, vol %: 13.64
Gravity, °API: 41.2
P/N/A, vol %: 36.4/49.3/14.3
Freezing pt, °F.: −50
Smoke pt, mm: 20
Aniline pt, °F.: 132.1
Diesel index: 54
Cetane index: 39
Sulfur, wt %: 0.05

**Light gas oil**
Range, °F.: 380—710
Yield, vol %: 42.63
Gravity, °API: 33.1
Pour pt, °F: 15
Aniline pt, °F.: 151.4
Sulfur, wt %: 0.11

**Heavy gas oil**
Range, °F.: 710—850
Yield, vol %: 12.18
Gravity, °API: 22.7
Pour pt, °F.: 95
Kin. vis., cSt @ 100° F.: 68.55
Aniline pt, °F.: 178.7
Diesel index: 41
Sulfur, wt %: 0.16
Nitrogen, total, ppm: 679
Con. carbon, wt %: 0.02

**Residue**
Range, °F.: 710+
Yield, vol %: 24.65
Gravity, °F.: 17.9
Pour pt, °F.: 110
Kin. vis., cSt @ 100° F.: 900.93
Sulfur, wt %: 0.23
Nitrogen, total, ppm: 1,604
Con. carbon residue, wt %: 3.36
V/Ni, ppm: 1.2/13.1

## Salt Pond, Ghana

*SALM with hawser-moored permanent storage in offshore producing area*

**Crude**
Gravity, °API: 37.4
Sulfur, wt %: 0.097
$C_1$—$C_3$ yield, vol %: 0.37

**Gasoline**
Range, °F.: 115—180
Yield, vol %: 9.23
RON, clear: 57.0

**Gasoline**
Range, °F.: 180—220
Yield, vol %: 2.90
RON, clear: 51.0

**Naphtha**
Range, °F.: 220—250
Yield, vol %: 2.50
RON, clear: 46.5

**Naphtha**
Range, °F.: 250—320
Yield, vol %: 7.20

**Heavy naphtha**
Range, °F.: 320—360
Yield, vol %: 4.30
Aniline pt, °F.: 138

**Kerosine**
Range, °F.: 360—500
Yield, vol %: 16.30
Gravity, °API: 43.7
Pour pt, °F.: −36
Sulfur, wt %: 0.020
Aniline pt, °F.: 148

**Gas oil**
Range, °F.: 500—600
Yield, vol %: 10.90
Gravity, °API: 37.3
Pour pt, °F.: 11
Sulfur, wt %: 0.030
Aniline pt, °F.: 163

**Gas oil**
Range, °F.: 600—650
Yield, vol %: 5.10
Gravity, °API: 34.4
Pour pt, °F.: 38
Sulfur, wt %: 0.070
Aniline pt, °F.: 173

**Heavy gas oil**
Range, °F.: 650—940
Yield, vol %: 21.20
Gravity, °API: 27.9
Sulfur, wt %: 0.110
Nitrogen, %: 0.0300

**Vacuum bottoms**
Range, °F.: 940+
Yield, vol %: 20.00
Gravity, °API: 17.6
Sulfur, wt %: 0.250
K factor: 11.89
Vis., Sfs @ 210° F.: 263.0

## Soyo Blend, Angola

*Quinfequena terminal*

**Crude**
Gravity, °API: 33.7
Sulfur, wt %: 0.23
Pour pt, °C.: +18
Vis., cSt @ 37.8° C.: 10.08
Asphaltenes, wt %: 0.72
Total acidity, mg KOH/g: 0.07
Wax content, wt % @ —30° C.: 14.7
V/Ni, ppm: 5/15
$C_1$—$C_5$ (GLC), yield, wt %: 2.33

**Gasoline**
Range (TBP), °C.: $C_5$—80
Yield, vol %: 3.86
RON + 0.4 g TEL/l: 83.7

**Heavy naphtha**
Range, °C.: 80—150
Yield, vol %: 9.63
Density @ 15° C.: 0.745
Naphthenes, vol %: 37.2
Aromatics, vol %: 10

**Kerosine**
Range, °C.: 150—230
Density @ 15° C.: 0.793
Sulfur, wt %: 0.021
Freeze pt, °C.: −53
Aromatics, vol %: 16
Smoke pt, mm: 25
Naphthenic acids, ppm: 68

**Gas oil**
Range, °C.: 230—340
Yield, vol %: 19.99
Density @ 15° C.: 0.838

Sulfur, wt %: 0.12
Cloud pt, °C.: −8
Cetane index: 53.0
Vis., cSt @ 50° C.: 2.73

**Heavy gas oil**
Range, °C.: 340—510
Yield, vol %: 26.22
Density @ 15° C.: 0.8824
Sulfur, wt %: 0.24
Aniline pt, °C.: 94.0
Basic nitrogen, ppm: 298
Total nitrogen, wt %: 0.10
Con. carbon, wt %: 0.01
V/Ni, ppm: <2/<2

**Residue**
Range, °C.: 340+
Yield, vol %: 52.16
Density @ 15° C.: 0.920
Sulfur, wt %: 0.21
Vis., cSt @ 50° C.: 160.8
Con. carbon, wt %: 5.5

## Zaire, Zaire

*CALM with moored storage in offshore producing area*

**Crude**
Gravity, °API: 31.7
Sulfur, wt %: 0.13
Vis., SUS @ 100° F.: 98.0
Pour pt, °F.: +80
$C_4$ & lighter, vol %: 1.00
Rvp, lb: 2.2
V/Ni, ppm: 1.5/17.8
Salt, lb/1,000 bbl: 6
ASTM, 50% pt, °F.: >590

**Light naphtha**
Range (TBP), °F.: Ibp—140°
Yield, vol %: 1.84
Sulfur, wt %: 0.037
RON, clear: 79.4

**Light naphtha**
Range, °F.: 140—170
Yield, vol %: 1.03
Sulfur, wt %: 0.020
Paraffins, vol %: 76.5
Naphthenes, vol %: 22.2
Aromatics, vol %: 1.3
RON, clear: 65.7

**Heavy naphtha**
Range, °F.: 170—310
Yield, vol %: 8.84
Sulfur, wt %: 0.006
P/N/A, vol %: 53.8/41.6/4.6
Aniline pt, °F.: 133.5

**Kerosine**
Range, °F.: 310—520
Yield, vol %: 16.31
Sulfur, wt %: 0.074
Freezing pt, °F.: −36
Aniline pt, °F.: 147.2
Cetane index: 50.0
Smoke pt, mm: 27

**Light gas oil**
Range, °F.: 520—680
Yield, vol %: 15.44
Vis., SUS @ 100° F.: 45.0
Sulfur, wt %: 0.14
Pour pt, °F.: +45
Diesel index: 62.4
Cetane index: 62.0

**Heavy gas oil**
Range (TBP to EFV), °F.: 680—1,000
Yield, vol %: 31.39
Gravity, °API: 26.7
Vis., SUS @ 210° F.: 54.0
Sulfur, wt %: 0.12
Total nitrogen, ppm: 1,010
Pour pt, °F.: +115
Aniline pt, °F.: 214.3
V/Ni, ppm: 0.1/0.3

**Residual oil**
Range, °F.: 680+
Yield, vol %: 55.65
Gravity, °API: 21.4
Vis., SUS @ 210° F.: 181.9
Sulfur, wt %: 0.17
Con. carbon res., wt %: 6.03
Pour pt, °F.: +100
V/Ni, ppm: 2.5/30
*Does not include $C_4$ and lighter

# North Africa

## Amna (high pour), Libya

*Ras Lanuf/CBMs & SPM*

**Crude**
Gravity, °API: 36.1
Sulfur, wt %: 0.15
Pour pt, °F.: 75
Kin. vis., cSt @ 37.8° C.: 13.70
Car. residue (CCR), wt %: 3.7
Rvp, psi: 3.9
Salt, lb/1,000 bbl: 8.2
V/Ni, ppm: 0.6/5.0
Ibp-60° F., yield, vol %: 2.11

**Light naphtha**
Range, °F.: 60-120
Yield, vol %: 2.4
Gravity, °API: 93.5
Sulfur, wt %: 0.01
Paraffins, vol %: 99.0
Naphthenes, vol %: 1.0
RON, clear: 78.0
RON + 3 ml TEL: 94.0

**Light naphtha**
Range, °F.: 120-250
Yield, vol %: 7.7
Gravity, °API: 69.5
Sulfur, wt %: 0.01
Paraffins, vol %: 69.9
Naphthenes, vol %: 26.5
Aromatics, vol %: 3.7

**Heavy naphtha**
Range, °F.: 250-330
Yield, vol %: 6.9
Gravity, °API: 57.4
Sulfur, wt %: 0.02
P/N/A, vol %: 60.5/33.6/5.9

**Kerosine**
Range, °F.: 330-443
Yield, vol %: 9.4
Gravity, °API: 49.9
Sulfur, wt %: 0.05
P/N/A, vol %: 60.9/29.9/9.2
Pour pt, °F.: −75
Freezing pt, °F.: −58
Aniline pt, °F.: 150.6
Diesel index: 75
Smoke pt, mm: 31

**Gas oil**
Range, °F.: 443-600
Yield, vol %: 15.0
Gravity, °API: 42.3
Sulfur, wt %: 0.07
Pour pt, °F.: 0
Aniline pt, °F.: 169.1
Diesel index: 71

**Gas oil**
Range, °F.: 600-850
Yield, vol %: 23.3
Sulfur, wt %: 0.13
Pour pt, °F.: 80
Aniline pt, °F.: 202.0
Diesel index: 69

**Residual oil**
Range, °F.: 655+
Yield, vol %: 55.4
Gravity, °API: 25.4
Sulfur, wt %: 0.22
Pour pt, °F.: 100
Car. residue CCR, wt %: 6.22
V/Ni, ppm: 1.1/8.5

**Residual oil**
Range, °F.: 1,000+
Yield, vol %: 21.8
Gravity, °API: 16.7
Sulfur, wt %: 0.31
Pour pt, °F.: 130
Car. residue CCR, wt %: 14.50
V/Ni, ppm: 2.5/20.0

## Ashtart, Tunisia

*Floating storage barge in Gulf of Gabes producing area*

**Crude**
Gravity, °API: 29.03
Vis. @ 20° C., cSt: 24.0
Pour pt, °C.: +9
Rvp @ 38.7° C., g/sq cm: 130
Total sulfur, wt %: 1.0
Paraffins/Asphaltenes, wt %: 11.0/1.8
Con. carbon, wt %: 5.4
$>C_1$-$C_5$, vol %: 1.26
V/Ni, mg/kg: 20/9

**Light naphtha**
Range (TBP), °C.: 15-100
Yield, vol %: 5.65
Density, 15/4 °C.: 0.702
Rvp, g/sq cm: 500
RON, clear: 63.6
Aromatics, vol %: 10.0

**Heavy naphtha**
Range (TBP), °C.: 100-145
Yield, vol %: 6.42
Density, 15/4 °C.: 0.759
Paraffins, vol %: 47.2
Naphthenes, vol %: 37.8
Aromatics, vol %: 15.0
Sulfur, wt %: 0.0055

**Heavy naphtha**
Range (TBP), °C.: 145-180
Yield, vol %: 5.91
Density, 15/4 °C.: 0.785
P/N/A, vol %: 46.5/33.8/19.7
Sulfur, wt %: 0.0120

**Kerosine**
Range (TBP), °C.: 180-225
Yield, vol %: 6.65
Density, 15/4 °C.: 0.812
Freeze pt, °C.: −54
Vis., cSt @ 50° C.: 1.10
Smoke pt, mm: 21
Sulfur, wt %: 0.04
Aniline pt, °C.: 54.0
Aromatics, vol %: 18.9

**Gas oil**
Range (TBP), °C.: 145-350
Yield, vol %: 36.04
Density, 15/4 °C.: 0.834
Pour pt, °C.: −21
Cloud pt, °C.: −16
Filterability, °C.: −19
Vis, cSt @ 50° C.: 1.9
Cetane index: 48.8
Sulfur, wt %: 0.44
Diesel index: 54.7
Aniline pt, °C.: 62.0
Con. carbon @ 10%, wt %: <0.05

**Residue**
Range (TBP), °C.: 350+
Yield, vol %: 51.90
Density, 15/4 °C.: 0.943
Pour pt, °C.: +18
Vis. cSt, @ 50° C.: 225
Sulfur, wt %: 1.42
Con. carbon, wt %: 9.4
V/Ni, ppm: 34/17
N, wt %: 0.40

## Brega, Libya

### *Marsa el Brega/ CBM, SPM, SBM*

**Crude**
Gravity, °API: 40.4
Sulfur, wt %: 0.21
Pour pt, °F.: +30
Rvp, psi: 6.4
Kin., cSt @ 70° F.: 5.58
@ 100° F.: 3.56

**Light naphtha**
Range, °F.: 68-212
Yield, vol %: 12.4
Gravity, °API: 73.8
Sulfur, wt %: 0.014
Rvp, psi: 7.4
Paraffins, vol %: 72.5
Naphthenes, vol %: 25.3
Aromatics, vol %: 2.2
RON, clear: 65.1

**Heavy naphtha**
Range, °F.: 212-302
Yield, vol %: 10.7
Gravity, °API: 56.8
Sulfur, wt %: 0.020
P/N/A, vol %: 53.1/39.4/7.5

**Kerosine**
Range, °F.: 302-455
Yield, vol %: 17.4
Gravity, °API: 46.7
Sulfur, wt %: 0.035
P/N/A, vol %: 51.2/34.7/14.1
Freeze pt, °F.: −70
Smoke pt, mm: 27
Luminometer no.: 61
Aniline pt, °F.: 144
Kin. vis., cSt @ 30° F.: 5.50
@ 100° F.: 1.17

**Light gas oil**
Range, °F.: 455-650
Yield, vol %: 20.3
Gravity, °API: 38.1
Sulfur, wt %: 0.10
Pour pt, °F.: +15
Aniline pt, °F.: 172
Kin. vis., cSt @ 100° F.: 3.61

**Heavy gas oil**
Range, °F.: 650-1,049
Yield, vol %: 27.8
Gravity, °API: 27.7
Sulfur, wt %: 0.30
Pour pt, °F.: 105
Aniline pt, °F.: 206
Kin. vis., cSt @ 150° F.: 14.9

**Residual oil**
Range, °F.: 650+
Yield, vol %: 36.8
Gravity, °API: 23.6
Sulfur, wt %: 0.41
Pour pt, °F.: 95
Con. carbon wt %: 4.1
Kin. vis., cSt @ 100° F.: 184
@ 122° F.: 92.0

**Residual oil**
Range, °F.: 1,049+
Yield, vol %: 9.0
Gravity, °API: 12.3
Sulfur, wt %: 0.69
Pour pt, °F.: >120
Con. carbon, wt %: 14.6
Kin. vis., cSt @ 210° F.: 620
V/Ni/Fe, ppm: 24/32/124

## Bu Attifel, Libya

### *Zueitina/CBM & SBM*

**Crude**
Gravity, °API: 43.6
Rvp, psi: 0
Sulfur, wt %: 0.034
Pour pt, °F.: +90

**Light ends**
Range vapor temp., °F.: Ibp-160
Yield, vol %: 2.5

**Light naphtha**
Range, vapor temp., °F.: 160-290
Yield, vol %: 9.0
Gravity, °API: 62.5
Paraffins, vol %: 75.4
Olefins, vol %: 0.4
Naphthenes, vol %: 18.3
Aromatics, vol %: 5.9

**Heavy naphtha**
Range, VT, °F.: 290-390
Yield, vol %: 9.0
Gravity, °API: 56.8
Sulfur, wt %: 0.0015
P/O/N/A, vol %: 75.7/0.4/17.8/6.1

**Kerosine**
Range, VT, °F.: 390-500
Yield, vol %: 11.7
Gravity, °API: 50.3
Sulfur, wt %: 0.005
Aromatics, vol %: 5.6
Smoke pt, mm: 22
Freeze pt, °F.: 9.4
Pour pt, °F.: −10

**Diesel**
Range, VT, °F.: 500-635
Yield, vol %: 11.3
Gravity, °API: 44.0
Sulfur, wt %: 0.0140
Vis., SSU @ 100° F.: 38.4
Aniline pt, °F.: 192.5
Diesel index: 84.7
Pour pt, °F.: 45

**Lt. gas oil**
Range, VT, °F.: 635-775
Yield, vol %: 20.7
Gravity, °API: 41.6
Sulfur, wt %: 0.03
Vis., SSU @ 100° F.: 49.5
Pour pt, °F.: +85
UOP "K" factor: 12.6

**Heavy gas oil**
Range, VT, °F.: 775-932
Yield, vol %: 20.6
Gravity, °API: 37.4
Sulfur, wt %: 0.04
Vis., SSF @ 210° F.: 41.6
Pour pt, °F.: +125
UOP "K" factor: 12.8

**Residue**
Range, °F.: 932+
Yield, vol %: 15.2
Gravity, °API: 29.2
Sulfur, wt %: 0.10
Carbon residue, wt %: 1.5

## El Borma, Tunisia

### *La Skhirra, Tunisia*

**Crude**
See Algerian Zarzaitine assay. One blend has two names.

## Es Sider, Libya

### *Es Sider/3 CBMs, 1 SBM*

**Crude**
Gravity, °API: 36.7
Kin. vis., cSt @ 100° F.: 5.26
Con. carbon residue, wt %: 1.8
Sulfur, wt %: 0.37
V/Ni, ppm: 1.5/5.6
Pour pt, °C.: +7.2
Rvp, psi: 6.3
$C_4$ & lighter, vol %: 2.3

**Naphtha**
Range (TBP), °F.: 82-342
Yield, vol %: 22.2
Gravity, °API: 64.8
Paraffins, vol %: 57.8
Naphthenes, vol %: 36.5
Sulfur, wt %: 0.03

**Kerosine**
Range (TBP), °F.: 342-472
Yield, vol %: 11.3
Gravity, °API: 46.3
Sulfur, wt %: 0.13
Aromatics, vol %: 13

**Heavy distillate**
Range (TBP), °F.: 472-705
Yield, vol %: 28.0
Gravity, °API: 35.7
Sulfur, wt %: 0.31

**Gas oil**
Range (TBP), °F.: 705-980
Yield, vol %: 20.3
Gravity, °API: 25.5
Sulfur, wt %: 0.48

**Residue**
Range (TBP), °F.: 980+
Yield, vol %: 15.9
Gravity, °API: 12.3
Sulfur, wt %: 1.16
Kin. vis., cSt @ 210° F.: 500
Con. carbon residue, wt %: 14.7
V/Ni, ppm: 8/30

## Saharan Blend,* Algeria

### *Arzew (3 CBMs)*
### *Bejaia (4 jetties)*
### *Skikda*

**Crude**
Gravity, °API: 45.5 (43.7)
Rvp, psi: 8.7 (8.1)
Sulfur, wt %: 0.053 (0.090)
Pour pt, °F.: <−20 (<−20)
Vis. SSU @ 70° F.: 37.3 (40.1)

**Light ends**
Range, vapor temp., °F.: Ibp-160
Yield, vol %: 10.4 (9.9)

**Light naphtha**
Range, vapor temp., °F.: 160-290
Yield, vol %: 18.3 (14.9)
Gravity, °API: 64.0 (63.7)
Paraffins, vol %: 70.8 (70.2)
Olefins, vol %: 0.3 (0.4)
Naphthenes, vol %: 21.8 (23.4)
Aromatics, vol %: 7.1 (6.0)

**Heavy naphtha**
Range, VT, °F.: 290-390
Yield, vol %: 13.7 (14.5)
Gravity, °API: 53.3 (52.1)
P/O/N/A, vol %: 47.4/0.3/36.4/15.9 (55.0/0.3/29.6/15.1)

**Kerosine**
Range, VT, °F.: 390-500
Yield, vol %: 14.1 (13.4)
Gravity, °API: 44.6 (44.0)
Sulfur, wt %: 0.0056 (0.0030)
Aromatics, vol %: 15.8 (16.4)
Smoke pt, mm: 17 (21)
Freeze pt, °F.: −38.2 (−42.7)

**Diesel**
Range, VT, °F.: 500-635
Yield, vol %: 12.7 (12.8)
Gravity, °API: 36.6 (35.1)
Sulfur, wt %: 0.0571 (0.0736)
Vis. SSU @ 100° F.: 41.6 (40.3)
Pour pt, °F.: +15 (+5)
Aniline pt, °F.: 170 (165.5)
Diesel index: 62.2 (58.1)

**Light gas oil**
Range, VT, °F.: 635-775
Yield, vol %: 9.3 (14.3)
Gravity, °API: 31.1 (31.7)
Sulfur, wt %: 0.07 (0.13)
Vis. SSU @ 100° F.: 57.5 (63.0)
Pour pt, °F.: +50 (+40)

**Heavy gas oil**
Range, VT, °F.: 775-932
Yield, vol %: 12.0 (10.0)
Gravity, °API: 28.6 (26.5)
Sulfur, wt %: 0.10 (0.18)
Vis., SSU @ 210° F.: 49.6 (54.5)
Pour pt, °F.: +90 (+90)
Carbon residue, wt %: 0.05 (0.06)

**Residue**
Range, VT, °F.: 932+
Yield, vol %: 9.5 (10.2)
Gravity, °API: 21.2 (19.9)
Sulfur, wt %: 0.22 (0.28)
Vis., SSF, @ 210° F.: 38.0 (45.1)
Carbon residue, wt %: 6.8 (7.4)

*Gravity of Saharan Blend has not been consistent. Values in parenthesis are those for 43.7 °API blend.

## Sarir, Libya

### *Marsa al Hariga (Tobruk)/CBM*

**Crude**
Gravity, °API: 38.3
Sulfur, wt %: 0.18
Pour pt, °F.: 25
Kin. vis. cSt @ 50° C.: 4.73
Yield, $C_2$-$C_4$, vol %: 3.82
V/Ni, ppm: 6/14

**Naphtha**
Range, °C.: Ibp-180
Yield, vol %: 22.89
Total sulfur, ppm: 14
Paraffins, vol %: 60.8
Naphthenes, vol %: 35.8
Aromatics, vol %: 3.4

**Kerosine**
Range, °C.: 180-250
Yield, vol %: 11.27
Total sulfur, ppm: 83
Smoke pt, mm: 30

**Gas oil**
Range, °C.: 250-320
Yield, vol %: 10.99
Total sulfur, wt %: 0.063
Pour pt, °C.: −6
Aniline pt, °C.: 80

**Resid**
Range, °C.: 320+
Yield, vol %: 51.41
Total sulfur, wt %: 0.24
Vis. cSt @ 60° C.: 49
Con. carbon, wt %: 6.8

**Resid**
Range, °C.: 550+
Yield, vol %: 17.25
Total sulfur, wt %: 0.35
Con. carbon, wt %: 20
Asphaltenes, wt %: 4.7

## Sirtica, Libya

### *Ras Lanuf/CBMs & SBM*

**Crude**
Gravity, °API: 43.3
Total sulfur, wt %: 0.43
Pour pt, °C.: −3
Yield $C_2$-$C_4$, wt %: 3.24
Rvp, psi: 10.1

**Condensate**
Yield, vol %: 42

**Naphtha**
Range, °C.: Ibp-180
Yield, vol %: 39.7
Gravity, °API: 62.8
Total sulfur, wt %: 0.015
P/N/A, vol %: 69.7/22.8/7.5

**Gas oil**
Range, °C.: 180-350
Yield, vol %: 29.8
Gravity, °API: 38.7
Total sulfur, wt %: .21
Pour pt, °C.: −15

**Resid**
Range, °C.: 350+
Yield, vol %: 25.5
Gravity, °API: 19.1
Total sulfur, wt %: 1.16
Vis. cSt @ 180° F.: 39.0
Pour pt, °C.: 39
Con. carbon, wt %: 5.7

## Zarzaitine, Algeria

### *La Skhirra, Tunisia*

**Crude**
Gravity, °API: 43.0
Vis. cSt @ 10° C.: 6.90
Pour pt, °C.: −12
Rvp @ 37.8° C., g/sq cm: 603
Total sulfur, wt %: 0.07
Paraffins, wt %: 4.89
Con. carbon, wt %: 0.90
V/Ni, mg/kg: 1/3
Yield $C_1$-$C_5$, vol %: 7.31

**Light naphtha**
Range, °C.: $C_5$-80
Yield, vol %: 8.94
Density, 15/4 °C.: 0.662
RON, clear: 68.8
MON, clear: 64.6
Aromatics, vol %: 0.9

**Heavy naphtha**
Range, °C.: 80-145
Yield, vol %: 15.13
Density, 15/4 °C.: 0.738
Paraffins, vol %: 59.4
Naphthenes, vol %: 33.9
Aromatics, vol %: 6.7
Sulfur, wt %: 0.0138

**Kerosine**
Range, °C.: 145-225
Yield, vol %: 16.58
Density, 15/4 °C.: 0.784
Freeze pt, °C.: −65
Vis. cSt @ 34.4° C.: 4.50
Smoke pt, mm: 25
Sulfur, wt %: 0.0162
Aromatics, vol %: 14.2

**Gas oil**
Range, °C.: 225-290
Yield, vol %: 12.55
Density, 15/4 °C.: 0.822
Pour pt, °C.: −36
Cloud pt, °C.: −27
Filterability, °C.: −34
Vis. cSt @ 50° C.: 1.95
Sulfur, wt %: 0.025

**Gas oil**
Range, °C.: 290-350
Yield, vol %: 10.89
Density, 15/4 °C.: 0.843
Pour pt, °C.: −3
Vis. cSt @ 50° C.: 4.18
Sulfur, wt%: 0.045

**Residue**
Range, °C.: 350+
Yield, vol %: 32.47
Pour pt, °C.: +21
Density, 15/4 °C.: 0.899
Vis., cSt @ 50° C.: 80
Sulfur, wt %: 0.155
Asphaltenes, wt %: 0.21
Con. carbon, wt %: 2.48
V, ppm: 2.5

## Zueitina, Libya

### *Zueitina/CBMs & SBM*

**Crude**
Gravity, °API: 41.3
Rvp, psi: 4.6
Sulfur, wt %: 0.28
Pour pt, °F.: 45
Vis. SSU @ 60° F.: 199.1

**Light ends**
Range, °F.: Ibp–113
Yield, vol %: 6.44

**Light naphtha**
Range, °F.: 113-220
Yield, vol %: 9.32
Gravity, °API: 66.9
Paraffins, vol %: 65.5
Naphthenes, vol %: 30.9
Aromatics, vol %: 3.6

**Naphtha**
Range, °F.: 220-390
Yield, vol %: 21.42
Gravity, °API: 53.9
Sulfur, wt %: 0.04
P/N/A, vol %: 59.2/27.0/10.2

**Kerosine**
Range, °F.: 315-500
Yield, vol %: 21.65

Gravity, °API: 45.6
Total sulfur, wt %: 0.11
Aromatics, vol %: 14.0
Smoke pt, mm: 27
Freeze pt, °F.: −36
Pour pt, °F.: −45

**Light distillate**
Range, °F.: 390-550
Yield, vol %: 18.16
Gravity, °API: 41.7
Cetane index: 53.0
Total sulfur, wt %: 0.17
Aniline pt, °F.: 159.0
Pour pt, °F.: −10

**Light gas oil**
Range, °F.: 450-650
Yield, vol %: 21.17
Gravity, °API: 38.4
Cetane index: 57.8
Total sulfur, wt %: 0.24
Total nitrogen, ppm: 78
Aniline pt, °F.: 173.0
Pour pt, °F.: 25

**Heavy gas oil**
Range, °F.: 650-1,000
Yield, vol %: 24.09
Gravity, °API: 29.1
Sulfur, wt %: 0.36
Total nitrogen, ppm: 922
Pour pt, °F.: 100
Carbon residue, wt %: 0.18

**Vacuum flashed resid**
Range, °F.: 1,000+
Yield, vol %: 10.11
Gravity, °API: 13.5
Total sulfur, wt %: 0.90

# Asia

## Ardjuna, Indonesia

*SBM 18.5 miles off north coast of Java in producing area*

**Crude**
Gravity, °API: 35.2
Sulfur, wt %: 0.105
Pour pt, °F.: 75
Rvp, lb: 5.3
Kin. vis. @ 100° F.: 3.738
Carbon residue, wt %: 1.38
V/Ni, ppm: <1/3
Nitrogen, ppm: 280
Yield, $C_4$ & lighter, vol %: 2.6

**Naphtha**
Range (TBP), °F.: $C_5$—150
Yield, vol %: 5.0
Sulfur, wt %: 0.005
RON, clear: 76.6
RON + 0.5 g TEL/gal: 82.7
MON, clear: 74.8

**Heavy naphtha**
Range, °F.: 150-380
Yield, vol %: 27.2
Gravity, °API: 50.8
Sulfur, wt %: 0.012
Paraffins, vol %: 34.3
Naphthenes, vol %: 46.0
Aromatics, vol %: 19.7
RON, clear: 64.6
MON, clear: 63.0

**Distillate**
Range, °F.: 380-520
Yield, vol %: 16.4
Gravity, °API: 33.0
Sulfur, wt %: 0.059
Pour pt, °F.: −65
Cetane no.: 36.3
Smoke pt, °F.: 12.5
Freezing pt, °F.: −39.5
Aromatics, vol %: 34.6
Total N, ppm: 4.0
Cloud pt, °F.: −46
Vis., cSt @ 100° F.: 1.967

**Distillate**
Range, °F.: 520-650
Yield, vol %: 14.0
Gravity, °API: 30.7
Sulfur, wt %: 0.099
Pour pt, °F.: −65
Cetane no.: 47.0
Total N, ppm: 33.0
Cloud pt, °F.: −26
Vis., cSt @ 100° F.: 4.689

**Blended gas oil**
Range, °F.: 650-840
Yield, vol %: 16.9
Gravity, °API: 25.1
Sulfur, wt %: 0.156
Aniline pt, °C.: 86.7
Pour pt, °F.: 90
Kin. vis. @ 210° F.: 3.983
Carbon residue, wt %: 0.02
Total nitrogen, ppm: 200

**Residue**
Range, °F.: 650+
Yield, vol %: 34.8
Gravity, °API: 21.1
Sulfur, wt %: 0.199
Carbon residue, %: 2.94
Total nitrogen, ppm: 670
Pour pt, °F.: 100
Kin. vis. @ 210° F.: 5.414

**Vacuum residue**
Range: Bottoms from vacuum flashed 650+ °F. resid @ 725° F
Yield, vol %: 5.9
Gravity, °API: 5.1
Sulfur, wt %: 0.292
Carbon residue, wt %: 17.86
V/Ni, ppm: 7/30

## Arimbi, Indonesia

*Balongan sea terminal/SBM about 6.5 nautical miles off north coast of Java*

**Crude**
Gravity, °API: 31.8
Sulfur, wt %: 0.204
Pour pt, °F.: 100
Vis., cSt @ 100° F.: 12.54
Carbon residue, wt %: 2.41
V/Ni, ppm: 0.9/2.6
Nitrogen, ppm: 531

**Naphtha**
Range (TBP), °F.: $C_5$—230
Yield, vol %: 10.6
Sulfur, wt %: <0.001
RON, clear: 64.6
RON + 0.5 g TEL/gal: 71.7

**Naphtha**
Range, °F.: 230-335
Yield, vol %: 11.2
Sulfur, wt %: 0.030
Total nitrogen, ppm: 1
Paraffins, vol %: 42.3
Naphthenes, vol %: 47.0
Aromatics, vol %: 10.7

**Distillate**
Range, °F.: 335-520
Yield, vol %: 17.3
Gravity, °API: 34.6
Sulfur, wt %: 0.107
Cetane no.: 37.3
Smoke pt, °F.: 14
Freezing pt, °F.: −32
Aromatics, vol %: 35.3

**Distillate**
Range, °F.: 520-650
Yield, vol %: 14.7
Gravity, °API: 31.6
Sulfur, wt %: 0.213
Pour pt, °F.: 45
Cetane no.: 50.2
Cloud pt, °F.: 50
Vis., cSt @ 100° F.: 5.450

**Blended gas oil**
Range, °F.: 650-840
Yield, vol %: 15.9
Gravity, °API: 29.0
Sulfur, wt %: 0.168
Aniline pt, °C.: 93.4
Pour pt, °F.: 110
Vis., cSt @ 210° F.: 4.385
Carbon residue, %: 0.008
Nitrogen, ppm: 266

**Residue**
Range, °F.: 650+
Yield, vol %: 45.9
Gravity, °API: 20.5
Sulfur, wt %: 0.240
Carbon residue, %: 5.27
Total nitrogen, ppm: 1,010
Pour pt, °F.: 120+
Vis. @ 210° F. (D2170): 22.29
V/Ni ppm: 2.7/9.8

## Attaka, Indonesia

*Santan marine terminal about 80 miles north of Balikpapan, Kalimantan/SBM about 4 miles offshore*

**Crude**
Gravity, °API: 42.3
Vis., cSt @ 70° F.: 1.7
Pour pt, °F.: −10
Rvp @ 100° F., psi: 6.8
Total acid no., Mg KOH/g: 0.20
Sulfur, wt %: 0.09
Wax, wt %: 4.22
Con. carbon residue, wt %: 0.34
Charac. factor, K UOP: 11.5

**Naphtha**
Range, °C.: $C_5$—100
Yield, vol %: 15.3
RON, clear: 74.9

**Naphtha**
Range, °C.: 100-150
Yield, vol %: 17.6
Paraffins, vol %: 41
Naphthenes, vol %: 35
Aromatics, vol %: 24.7

**Kerosine**
Range, °C.: 150-250
Yield, vol %: 29.6
Smoke pt, mm: 16
Freezing pt, °C.: −54

**Gas oil**
Range, °C.: 250-350
Yield, vol %: 25
Diesel index: 51
Cetane no.: 52.6

**Fuel oil**
Range, °C.: 350+
Yield, vol %: 12.5
Sulfur, wt %: 0.11
Pour pt, °F.: 100

Note: Attaka is mixed wtih Badak crude and other streams and shipped with Attaka specifications

## Badak, Indonesia

*Santan terminal about 80 miles north of Balikpapan, Kalimantan/SBM some 4 miles offshore*

**Crude**
Gravity, °API: 41.3
Vis., cSt @ 100° F.: 5.72
Pour pt, °F.: −15
Rvp @ 100° F., psi: 5.6
Total acid number, mg KOH/g: 0.11
Sulfur, wt %: 0.08
Wax, wt %: 7.35
Con. carbon, wt %: 0.313
Charac. factor, K UOP: 12.5
Note: Badak is mixed with Attaka crude and shipped with Attaka specifications.

## Bekapai, Indonesia

*Senipah marine terminal about 27 miles northeast of Balikpapan, Kalimantan/SBM about 6 miles offshore*

**Crude**
Gravity, °API: 40
Sulfur, wt %: 0.08
Pour pt, °C.: −21
Rvp, psi: 1.9
Vis.,cSt @ 37.8° C.: 2.02
Con. carbon, wt %: 0.25
Asphaltenes, wt %: <0.05
V/Ni, ppm: <0.5/<0.5
Yield $C_4$ & lighter, wt %: 0.51

**Gasoline**
Range, °C.: $C_5$—100
Yield, wt %: 8.17
Gravity, °API: 63.6
Sulfur, ppm: <1
Paraffins, vol %: 45.8
Naphthenes, vol %: 47.6
Aromatics, vol %: 6.6
RON, clear: 73.8
RON + 0.6 g TEL/l: 88.5

**Naphtha**
Range, °C.: 100-185
Yield, wt %: 25.12
Gravity, °API: 49.1
Sulfur, ppm: 68
P/N/A, vol %: 33.2/48.9/17.9

**Kerosine**
Range, °C.: 185-230
Yield, wt %: 15.98
Gravity, °API: 42.5
Sulfur, wt %: 0.038
Aromatics, vol %: 18
Smoke pt, mm: 22
Freezing pt., °C.: −50.5

**Gas oil**
Range, °C.: 185-375
Yield, wt %: 52.06
Gravity, °API: 37.5
Sulfur, wt %: 0.083
Vis., cSt @ 37.8° C.: 2.62
Aniline pt, °C.: 67.6
Pour pt, °C.: −21

**Residue**
Range, °C.: 375+
Yield, wt %: 14.14
Gravity, °API: 18.9
Sulfur, wt %: 0.22
Vis., cSt @ 50° C.: 835
Pour pt, °C.: >+45
Con. carbon, wt %: 1.7
V/Ni, ppm: <2/2

## Bekok, Malaysia

*Piped ashore to terminal north of Chukai, Kuala Trengganu area, peninsular Malaysia as part of Tapis Blend*

**Crude**
Gravity, °API: 49.07
Vis., cSt @ 100° F.: 1.74
Pour pt, °F.: 26
Sulfur, ppm: 210
Total nitrogen, wt %: 0.0136
Neutralization no., mg KOH/g: 0.035
Rvp, psi: 7.6
Con. carbon residue, wt %: 0.22
V/Ni, ppm: <l/<l
Wax, wt %: 6.05
Yield, $C_4$ & lighter: 2.7

**Light naphtha**
Range, °F.: $C_5$-145
Yield (VT), vol %: 7.05
RON, clear: 72

**Heavy naphtha**
Range, °F.: 145-330
Yield, vol %: 26.76
Sulfur, ppm: 5
Total nitrogen, ppm: 0.7
RON, clear: 45
Paraffins, wt %: 57.40
Naphthenes, wt %: 29.27
Aromatics, wt %: 13.33

**Kerosine**
Range, °F.: 330-450
Yield, vol %: 15.74
Sulfur, ppm: 20
Freezing pt, °F.: −45
Cloud pt, °F.: −47
Smoke pt, mm: 20
Cetane index: 57.33
Diesel index: 76.48
Vis., cSt @ 70° F.: 1.64

**Distillate**
Range, °F.: 450—650
Yield, vol %: 26.13
Gravity, °API: 41.65
Sulfur, ppm: 220
Cetane index: 64.34
Diesel index: 74.34
Aniline pt, °C.: 81.5
Vis., cSt @ 70° F.: 5.15

**Heavy gas oil**
Range, °F.: 680-975
Yield, vol %: 15.85
Gravity, °API: 32.84
Sulfur, ppm: 600
Total nitrogen, ppm: 533
Pour pt, °F.: 113
Con. carbon residue, wt %: 0.059
Sodium, ppm: 13.84
V/Ni, ppm: 0.008/<0.01
Vis., cSt @ 130° F.: 11.32

**Atmospheric residue**
Range, °F.: 650+
Yield, vol %: 21.62
Gravity, °API: 31.54
Sulfur, ppm: 700
Pour pt, °F.: 113
Con. carbon residue, wt %: 1.986
Sodium, ppm: 0.125
V/Ni, ppm: <0.002/<0.01
Vis., cSt @ 130° F.: 27.37

Note: Bekok is contributor to Tapis blend

## Bintulu, Malaysia

*Bintulu SBM terminal off Sarawak*

**Crude**
Gravity, °API: 26.5
Vapor pressure, Kg/sq cm: 0.21
Pour pt, °C.: −5.0
Vis., cSt @ 56° C.: 4.54
Carbon residue, wt %: 1.69
Sulfur, wt %: 0.13
Acid no. KOH mg/g: 0.43
Nitrogen, ppm: 450
Distillation, °C.:
Ibp—28
5%—104
10%—135
15%—169
20%—199
25%—227
30%—245
35%—259
40%—273
45%—285
47%—290

Note: Bintulu comes solely from Temana field offshore Sarawak

## Bunyu, Indonesia

*Bunyu Island terminal off east coast of Kalimantan/Four point CBM*

**Crude**
Gravity, °API: 31.7
Vis., cSt @ 100° F.: 2.67
Pour pt, °F.: 60
Rvp @ 100° F., psi: 1.0
Sulfur, wt %: 0.09
Wax, wt %: 8.3
Con. carbon residue, wt %: 0.39
Charac. factor, K UOP: 11.4

**Gasoline**
Range, °C.: $C_5$—175
Yield, vol %: 18.5
RON, clear: 74.9

**Kerosine**
Range, °C.: 175-300
Yield, vol %: 49.0
Smoke pt, mm: 10

**Gas oil**
Range, °C.: 300-350
Yield, vol %: 13.0
Diesel index: 41

**Residue**
Range, °C.: 350+
Yield, vol %: 19.5
Sulfur, wt %: 0.20
Pour pt, °F.: 115

Note: In late 1982 there were plans to mix Bunyu with Sembakung crude (37 °API). This assay of sample that did not contain Sembakung.

## Champion Export, Brunei

### *Seria SBM*

**Crude**
Gravity, °API: 23.9
Vis. @ 10° C., sq mm/sec: 21.1
Sulfur, wt %: 0.12
Wax, wt %: 0.4
Pour pt, °C.: < −36
Total acid no., mg KOH/g: 0.50
UOP K factor: 11.2
Yield light hydrocarbons, wt %: 0.70

**Gasoline**
Range, °C.: $C_5$—65
Yield, vol %: 0.4
Rvp, kPa: 70

**Naphtha**
Range, °C.: 65—100
Yield, vol %: 2.0
Sulfur, mg/kg: 24
RON, clear: 77
RON + 0.5 g Pb/l (TEL): 88

**Naphtha**
Range, °C.: 100-150
Yield, vol %: 4.5
SUlfur, mg/kg: 74
RON, clear: 71
Paraffins, wt %: 20
Naphthenes, wt %: 69
Aromatics, wt %: 11

**Naphtha**
Range, °C.: 150-200
Yield, vol %: 8.1
Density @ 15° C., kg/l: 0.827
Sulfur, mg/kg: 251
P/N/A, wt %: 15/69/16
Smoke pt, mm: 22

**Kerosine**
Range, °C.: 200-250
Yield, vol %: 16.2
Density @ 15° C.: 0.870
Sulfur, wt %; 0.06
Cloud pt, °C. < −60
Smoke pt, mm: 18
Aniline pt, °C.: 46.9
Cetane no.: 31

**Gas oil**
Range, °C.: 250-300
Yield, vol %: 22.6
Density @ 15° C., kg/l: 0.899
Vis. @ 40° C., sq mm/sec: 3.84
Pour pt, °C.: −57
Aromatics, wt %: 36
Smoke pt, mm: 15
Cetane no.: 29

**Gas oil**
Range, °C.: 300-350
Yield, vol %: 15.2
Density @ 15° C., kg/l: 0.930
Vis. @ 40° C., sq mm/sec: 10.2
Sulfur, wt %: 0.17

**Heavy gas oil**
Range, °C.: 350-370
Yield, vol %: 4.5
Density @ 15° C., kg/l: 0.951
Pour pt, °C.: −6
Total nitrogen, mg/kg: 194

**Residue**
Range, °C.: 370 +
Yield, vol %: 26.4
Density @ 15° C.; kg/l: 0.991
Vis. @ 60° C., sq mm/sec: 912
Sulfur, wt %: 0.25
Pour pt, °C.: 21
V/Ni, mg/kg: <1/3

Note: Assay sample contained 67 vol % Champion crude, 18 vol % Magpie, and 15 vol % Seria Land Heavy.

## Cinta, Indonesia

### *SBM and floating storage barge in Java Sea producing area*

**Crude**
Gravity, °API: 33.4
Sulfur, wt %: 0.075
Pour pt, °F.: 105
Vis., cSt @ 100° F.: 64.34
Rvp, lb: 1.4
V/Ni, ppm: 0.1/9.5
Wax content, wt %: 30.3
$C_5$ & lighter, vol %: 3.143

**Light naphtha**
Range, °F.: $C_5$-180
Yield, vol %: 1.89
Sulfur, ppm: 2.3
RON, clear: 61.0
RON + 3 ml TEL/gal: 84.8

**Naphtha**
Range, °F.: 180-300
Yield, vol %: 4.84
Sulfur, ppm: 5.1
RON, clear: 48.4
RON + 3 ml TEL/gal: 74.4
Paraffins, vol %: 55.2
Olefins, vol %: 0.9
Naphthenes, vol %: 39.0
Aromatics, vol %: 4.9

**Heavy naphtha**
Range, °F.: 300-380
Yield, vol %: 4.02
Gravity, °API: 53.3
Sulfur, ppm: 12.0
P/O/N/A, vol %: 67.6/1.7/22.6/8.1

**Kerosine**
Range, °F.: 380-450
Yield, vol %: 2.04
Gravity, °API: 48.6
Sulfur, ppm: 91.4
Smoke pt, mm: 34
Pour pt, °F.: −30
Aniline pt, °F.: 156.7
Aromatics (FIA), %: 8.4
Cetane no.: 46.5
Diesel index: 76.2

**Gas oil**
Range, °F.: 450-650
Yield, vol %: 11.99
Gravity, °API: 42.2
Sulfur, wt %: 0.04
Cetane number: 58.5
Pour pt, °F.: 15
Vis., cSt @ 100° F.: 2.74

**Heavy gas oil**
Range, °F.: 650-1,050
Yield, vol %: 40.06
Gravity, °F.: 34.7
Sulfur, wt %: 0.065
Con. carbon, wt %: 0.07
Total nitrogen, wt %: 0.15
Basic nitrogen, wt %: 0.009
V/Ni, ppm: 0.1/0.1
Pour pt, °F.: 115
Aromatics (FIA), %: 15.6
Vis., cSt @ 130° F.: 10.0

**Residue**
Range, °F.: 650 +
Yield, vol %: 74.3
Gravity, °API: 27.6
Sulfur, wt %: 0.09
Con. carbon, wt %: 6.05
V/Ni, ppm: 0.1/2.3
Pour pt, °F.: >120
Total nitrogen, wt %: 0.25
Vis., cSt @ 130° F.: 123.7

## Daqing, China (see Taching)

## Duri (Sumatran Heavy), Sumatra, Indonesia

### *Port of Dumai, Sumatra*

**Crude**
Gravity, °API: 21.1
Sulfur, wt %: 0.20
Vis., cSt @ 122° F.: 131.9
Pour pt, °F.: 54
$C_4$ & lighter, vol %: 0.02

**Light naphtha**
Range (TBP), °F.: $C_5$-200
Yield, vol %: 0.48
Gravity, °API: 70.7
Sulfur, wt %: 0.007
Paraffins, vol %: 66.1
Naphtha, vol %: 33.5
Aromatics, vol %: 0.4

**Heavy naphtha**
Range (TBP), °F.: 200-340
Yield, vol %: 3.2
Gravity, °API: 51.1
Sulfur, wt %: 0.009
P/N/A, vol %: 31/62/7

**Kerosine**
Range (TBP), °F.: 340-460
Yield, vol %: 6.0
Gravity, °API: 36.3
Sulfur, wt %: 0.039
Smoke pt, mm: 18
Freeze pt, °F.: −73

**Gas oil**
Range (TBP), °F.: 460-650
Yield, vol %: 14.7
Gravity, °API: 27.4
Sulfur, vol %: 0.136
Pour pt, °F.: −1
Diesel index: 37.9

**Reduced crude**
Range (TBP), °F.: 650 +
Yield, vol %: 75.6
Gravity, °API: 17.6
Sulfur, wt %: 0.21
Pour pt, °F.: 86
Vis., cSt @ 122° F.: 1,134
Rams. carbon, wt %: 7.8
V/Ni/Fe, wt % ppm: 1/16/0

## Handil, Kalimantan, Indonesia

### *SBM about 6 miles offshore 27 miles northeast of Balikpapan*

**Crude**
Gravity, °API: 32.75
Sulfur, wt %: 0.079
Pour pt, +85 °F.
Rvp, psi: 1.6
Vis., cSt @ 37.8° C.: 4.2
Con. carbon, wt%: 1
V/Ni, ppm: <0.5/<1
$C_4$ & lighter, wt %: 0.5

**Gasoline**
Range, °C.: $C_5$—75
Yield, wt %: 2.2
Gravity, °API: 69.4
Sulfur, ppm: 5
Paraffins, vol %: 64
Naphthenes, vol %: 20.2
Aromatics, vol %: 15.8
RON, clear: 79.7
RON + 0.6 g TEL/l: 89.2

**Naphtha**
Range, °C.: 75-145
Yield, wt %: 11.4
Gravity, °API: 45.8
Sulfur, ppm: 9
P/N/A, vol %: 21.8/33.3/44.9

**Kerosine**
Range, °C.: 145-250
Yield, wt %: 19.3
Gravity, °API: 33.6
Sulfur, ppm: 136
Aromatics (FIA), vol %: 44.2
Smoke pt, mm: 9
Freezing pt, °C.: −49

**Gas oil**
Range, °C.: 145-350
Yield, wt %: 46.3
Gravity, °API: 31.6
Sulfur, wt %: 0.061
Vis., cSt @ 20° C.: 2.49
Aniline pt, °C.: 51.8
Pour pt, °C.: −7

**Residue**
Range, °C.: 350+
Yield, wt %: 39.6
Gravity, °API: 25.1
Sulfur, wt %: 0.13
Vis., cSt @ 50° C.: 46.7
Pour pt, °C.: +45
Con. carbon, wt %: 2.6
V/Ni, ppm: <1/<2

## Jatibarang, Java, Indonesia

*SBM terminal about 6.5 nautical miles off north coast of Java*

**Crude**
Gravity, °API: 29.0
Vis., cSt @ 122° F.: 83.8
Pour pt, °F.: 110
Rvp @ 100° F., psi: 0.2
Sulfur content, wt %: 0.07
Wax content, wt %: 24.6
Con. carbon residue, wt %: 7.53
Charac. factor, K UOP: 12.5

**Gasoline**
Range, °C.: Ibp-100
Yield, vol %: 3.6
RON, clear: 70.0

**Naphtha**
Range, °C.: 100-175
Yield, vol %: 7.9
Paraffins, vol %: 46.0
Naphthenes, vol %: 43.0
Aromatics, vol %: 11.0

**Kerosine**
Range, °C.: 175-250
Yield, vol %: 7.0
Smoke pt, mm: 21.0

**Gas oil**
Range, °C.: 250-350
Yield, vol %: 13.1
Diesel index: 67.5

**Residue**
Range, °C.: 350+
Yield, vol %: 68.4
Sulfur, wt %: 11.0
Pour pt, °F.: 120

## Labuan Blend, Sabah, Malaysia

*SBM in South China Sea off Labuan Island terminal*

**Crude**
Gravity, °API: 33.2
Vis., cSt @ 70° F.: 4.41
Pour pt, °F.: 52
Sulfur, ppm: 917
Neut. no., mg KOH/g: 0.30
Rvp, psi: 3.52
Con. carbon residue, wt %: 2.54
V/Ni, ppm: 0.015/<0.002
Wax content, wt %: 2.34
Asphaltene content, wt %: 0.22
$C_5$ & lighter, wt %: 1.3

**Light naphtha**
Range, °F.: $C_5$-145
Yield, vol %: 2.0
Sulfur, ppm: <5
Rvp, psi: 12.4

**Heavy naphtha**
Range, °F.: 145-330
Yield, vol %: 18.80
Sulfur, ppm: 20
RON, clear: 67.0
RON + 3 cc TEL/U.S. gal: 85.0
Paraffins, wt %: 17.52
Naphthenes, wt %: 74.58
Aromatics, wt %: 7.89

**Kerosine**
Range, °F.: 330-450
Yield, vol %: 18.00
Gravity, °API: 38.70
Sulfur, ppm: 140
Freezing pt, °F.: −81.4
Pour pt, °F.: <−17
Smoke pt, mm: 21
Cetane index: 34.39
Diesel index: 44

**Distillate**
Range, °F.: 450-650
Yield, vol %: 38.27
Gravity, °API: 29.27
Sulfur, wt %: 0.07
Cloud pt, °F.: 19.4
Cetane index: 40.09
Diesel index: 38
Aniline pt, °C.: 55
Con. carbon residue, wt %: nil
Vis., cSt @ 70° F.: 6.43

**Residue**
Range, °F.: 650+
Yield, vol %: 21.96
Sulfur, wt %: 0.15
Nitrogen, ppm: 531
Pour pt, °F.: 89.6
Con. carbon residue, wt %: 1.62
V/Ni, ppm: 0.03/0.08
Vis., cSt @ 100° F.: 125.8

**Heavy gas oil**
Range, °F.: 680-975
Yield, vol %: 16.83
Gravity, °API: 15.79
Sulfur, wt %: 0.14
Total nitrogen, ppm: 586
Basic nitrogen, ppm: 144
Pour pt, °F.: 98
Con. carbon residue, wt %: 0.30
Vis., cSt @ 100° F.: 173.61

Note: Labuan Blend comes from offshore fields connected to North Sabah Trunk Line. They include Samarang and South Furious. Erb West, St. Joseph and Barton were to be added during late 1983.

## Minas (Sumatran Light), Sumatra, Indonesia

*Port of Dumai, Sumatra*

**Crude**
Gravity, °API: 34.5
Sulfur, wt %: 0.081
Vis., cSt @ 122° F.: 12.4
Pour pt, °F.: 97
$C_4$ & lighter, vol %: 0.27

**Light naphtha**
Range (TBP), °F.: $C_5$-200
Yield, vol %: 2.83
Gravity, °API: 80.0
Sulfur, wt %: 0.001
Paraffins, vol %: 75
Naphtha, vol %: 25
Aromatics, vol %: nil

**Heavy naphtha**
Range (TBP), °F.: 200-340
Yield, vol %: 9.4
Gravity, °API: 60.2
Sulfur, wt %: 0.002
P/N/A, vol %: 62/30/8

**Kerosine**
Range (TBP), °F.: 340-460
Yield, vol %: 10.5
Gravity, °API: 47.2
Sulfur, wt %: 0.015
Smoke pt, mm: 35
Freeze pt, °F.: −34

**Gas oil**
Range (TBP), °F.: 460-650
Yield, vol %: 20.2
Gravity, °API: 39.6
Sulfur, vol %: 0.061
Pour pt, °F.: 44
Diesel index: 72

**Reduced crude**
Range (TBP), °F.: 650+
Yield, vol %: 56.8
Gravity, °API: 26.5
Sulfur, wt %: 0.15
Pour pt, °F.: 106
Vis., cSt @ 122° F.: 101.2
Rams. carbon, wt %: 5.1
V/Ni/Fe, wt % ppm: 1/15/10

## Miri Light, Sarawak, Malaysia

*SBMs off Miri terminal*

**Crude**
Gravity, °API: 36.27
Vis., cSt @ 70° F.: 3.65
Pour pt, °F.: 34
Sulfur, ppm: 825
Total nitrogen, wt %: 0.0137
Neut. no., mg KOH/g: 0.175
Rvp, psi: 4.7
Con. carbon residue, wt %: 2.94
V/Ni, ppm: 0.012/<0.002
Wax content, wt %: 2.83
Asphaltene content, wt %: 0.258
$C_5$ & lighter, wt %: 2.2

**Light naphtha**
Range, °F.: $C_5$-145
Yield, vol %: 1.60
Sulfur, ppm: <5
Rvp, psi: 10.5

**Heavy naphtha**
Range, °F.: 145-330
Yield, vol %: 23.10
Sulfur, ppm: 17
RON, clear: 66.5
RON + 3 cc TEL/U.S. gal: 84.5
Paraffins, wt %: 14.55
Naphthenes, wt %: 68.94
Aromatics, wt %: 16.51

**Kerosine**
Range, °F.: 330-450
Yield, vol %: 15.80
Sulfur, ppm: 125
Freezing pt, °F.: < -70
Gravity, °API: 40.65
Smoke pt, mm: 21
Cetane index: 35.3
Diesel index: 47

**Light distillate**
Range, °F.: 450-650
Yield, vol %: 33.09
Gravity, °API: 30.99
Sulfur, ppm: 600
Cetane index: 41.1
Diesel index: 43
Aniline pt, °C.: 60
Vis., cSt @ 70° F.: 6.23

**Residue**
Range, °F.: 650+
Yield, vol %: 25.26
Gravity, °API: 21.01
Sulfur, wt %: 0.17
Pour pt, °F.: 100.4
Con. carbon residue, wt %: 2.22
V/Ni, ppm: 0.030/<0.001
Vis., cSt @ 100° F.: 217.26

**Heavy gas oil**
Range, °F.: 680-975
Yield, vol %: 20.26
Gravity, °API: 20.71
Sulfur, ppm: 0.15
Total nitrogen, ppm: 584
Basic nitrogen, ppm: 95
Pour pt, °F.: 35
Vis., cSt @ 100° F.: 103.85

Note: Miri is blend of 7 offshore fields. Miri Land crude no longer produced.

## Pulai, Malaysia

*Piped ashore to terminal north of Chukai, Kuala Trengganu area, peninsular Malaysia, as part of Tapis Blend.*

**Crude**
Gravity, °API: 42.52
Vis., cSt @ 70° F.: 2.12
Pour pt, °F.: 23
Sulfur, ppm: 160
Total nitrogen, ppm: 33.5
Rvp, psi: 2.7
Con. carbon residue, wt %: 0.11
V/Ni, ppm: 1.4/0.1
Wax content, wt %: 3.11
Asphaltene content, wt %: 0.31
$C_4$ & lighter, vol %: 0.45

**Light naphtha**
Range, °F.: $C_5$-145
Yield, vol %: 2.03
Sulfur, ppm: <5

**Heavy naphtha**
Range, °F.: 145-330
Yield, vol %: 27.93
Sulfur, ppm: <5
RON, clear: <70
Paraffins, wt %: 31.83
Naphthenes, wt %: 26.44
Aromatics, wt %: 31.38

**Kerosine**
Range, °F.: 330-450
Yield, vol %: 27.85
Sulfur, ppm: 19
Freezing pt, °F.: -67
Pour pt, °F.: -66
Smoke pt, mm: 21
Cetane index: 43.17
Diesel index: 56.62
Vis., cSt @ 70° F.: 1.71

**Light distillate**
Range, °F.: 450-650
Yield, vol %: 34.14
Gravity, °API: 34.8
Sulfur, ppm: 270
Cloud pt, °F.: +14
Cetane index: 48.63
Diesel index: 54.04
Aniline pt, °C.: 68.5
Vis., cSt @ 70° F.: 5.01

**Residue**
Range, °F.: 650+
Yield, vol %: 7.60
Gravity, °API: 28.20
Sulfur, ppm: 800
Nitrogen, ppm: 323
Pour pt, °F.: 102
Aniline pt, °C.: 91
Con. carbon residue, wt %: 1.58
V/Ni, ppm: <0.01/<0.01
Vis., cSt @ 130° F.: 17.53
Note: Pulai is contributor to Tapis Blend

## Salawati, West Irian, Indonesia

*Salawati marine terminal (breasting and mooring dolphins and storage barge) on Sele Strait*

**Crude**
Gravity, °API: 38.0
Vis., cSt @ 100° F.: 4.2
Pour pt, °F.: -15
Rvp @ 100° F., psi: 0.6
Sulfur, wt %: 0.49
Wax content, wt %: 8.42
Con. carbon residue, wt %: 1.3
Charac. factor K UOP: 12.0

**Gasoline**
Range, °C.: $C_5$-94
Yield, vol %: 1.0

**Naphtha**
Range, °C.: 94-149
Yield, vol %: 10.7
Paraffins, vol %: 71.4
Naphthenes, vol %: 27.9
Aromatics, vol %: 0.8

**Kerosine**
Range, °C.: 149-260
Yield, vol %: 35.4
Smoke pt, mm: 35.5
Freezing pt, °F.: -28

**Gas oil**
Range, °C.: 260-344
Yield, vol %: 21.5
Cetane index: 58.6

**Residue**
Range, °C.: 344+
Yield, vol %: 31.4
Sulfur, wt %: 1.1
Pour pt, °F.: 115

## Sanga Sanga, Kalimantan, Indonesia

**Crude**
Gravity, °API: 25.7
Rvp, psi @ 100° F.: 0.8
Sulfur, wt %: 0.17
Pour pt, °F.: +5
V/Ni, ppm: nil/0.9
Vis., SUS @ 100° F.: 151.3
Con. carbon residue, wt %: 0.79

**Naphtha**
Range, °F.: Ibp-350
Yield, vol %: 13.2
Rvp, psi @ 100° F.: 2.7
Sulfur, wt %: 0.015

**Kerosine**
Range, °F.: 350-450
Yield, vol %: 12.4
Aniline pt, °C.: 118
Sulfur, wt %: 0.04
Smoke pt, mm: 16

**Diesel**
Range, °F.: 450-650
Yield, vol %: 41.6
Gravity, °API: 25.3
Aniline pt, °C.: 133
Cetane index (calc.): 36.5
Sulfur, wt %: 0.13
Pour pt, °F.: +25
Vis., SUS @ 100° F.: 41.6

**Fuel oil**
Range, °F.: 650+
Yield, vol %: 32.8
Gravity, °API: 19.3
Sulfur, wt %: 0.31
Pour pt, °F.: +105
V/Ni, ppm: Nil/1.4

## Sepinggan-Yakin Mixed (4:1), East Kalimantan, Indonesia

*Lawi-Lawi terminal about 12 miles south of Balikpapan/SBM about 6 miles offshore in Makasar Straits*

**Crude**
Gravity, °API: 31.7
Vis., cSt @ 100° F.: 3.16
Pour pt, °F.: 20
Rvp, psi @ 100° F.: 2.6
Total acid no., mg KOH/g: 0.3
Sulfur content, wt %: 0.11
Con. carbon residue, wt %: 0.54

**Gasoline**
Range, °C.: $C_5$-100
Yield, vol %: 1.5

**Naphtha**
Range, °C.: 100-175
Yield, vol %: 19.5

**Kerosine**
Range, °C.: 175-250
Yield, vol %: 21.5

**Gas oil**
Range, °C.: 250-350
Yield, vol %: 35.5

**Fuel oil**
Range, °C.: 350+
Yield, vol %: 22.0

## Seria Light, Brunei

*Lutong terminal*

**Crude**
Gravity, °API: 36.2
Rvp, psi: 6.0
Sulfur, wt %: 0.07
Pour pt, °F.: 35
Vis., SSU @ 80° F.: 36.5
Yield, Ibp-113° F., vol %: 5.77

**Gasoline**
Range, °F.: 113-220
Yield, vol %: 10.23
RON + 3 cc TEL/gal: 85.0

**Naphtha**
Range, °F.: 220-390
Yield, vol %: 21.41
Paraffins, vol %: 35.9
Naphthenes, vol %: 34.6
Dinaphthenes, vol %: 11.8
Aromatics, vol %: 17.7

**Light distillate**
Range, °F.: 390-550
Yield, vol %: 26.63
Gravity, °API: 33.0
Cetane index: 35.0
Sulfur, wt %: 0.04
Aniline pt, °F.: 129.5
Pour pt, °F.: −35
Range, °F.: 550-650
Yield, vol %: 13.88
Gravity, °API: 29.0

**Light gas oil**
Range, °F.: 450-650
Yield, vol %: 31.74
Gravity, °API: 30.1
Cetane index: 40.7
Sulfur, wt %: 0.07

**Heavy gas oil**
Range, °F.: 650-971
Yield, vol %: 18.89
Gravity, °API: 18.0
Sulfur, wt %: 0.15
Total nitrogen, ppm: 513
Basic nitrogen, ppm: 262
Pour pt, °F.: 95
Carbon residue, wt %: 0.18

**Vacuum flashed residue**
Range, °F.: 971+
Yield, vol %: 3.19
Gravity, °API: 10.0
Sulfur, wt %: 0.32

## Shengli, China

*Qingdao terminal on Yellow Sea*

**Crude**
Gravity, °API: 24.2
Rvp, psi: 0
Sulfur, wt %: 1.00
Pour pt, °F.: +70
Vis., SFS @ 122° F.: 48.3
Acid no.: 1.16

**Light ends**
Range, °F.: Ibp-160
Yield, vol %: 2.0

**Light naphtha**
Range, °F.: 160-290
Yield, vol %: 3.3
Paraffins, vol %: 45.9
Naphthenes, vol %: 44.7
Aromatics, vol %: 9.4

**Heavy naphtha**
Range, °F.: 290-390
Yield, vol %: 3.7
Gravity, °API: 47.5
Sulfur, wt %: 0.05
P/N/A, vol %: 48.9/30.9/20.2

**Kerosine**
Range, °F.: 390-500
Yield, vol %: 6.2
Gravity, °API: 39.9
Sulfur, wt %: 0.23
Olefins, vol %: 0.9
Aromatics, vol %: 16.5
Smoke pt, mm: 17
Freeze pt, °F.: −29.2

**Diesel**
Range, °F.: 500-660
Yield, vol %: 12.3
Gravity, °API: 34.7
Sulfur, wt %: 0.53
Pour pt, °F.: +40
Cetane index: 52.6
Cloud pt, °F.: +42

**Light gas oil**
Range, °F.: 660-780
Yield, vol %: 9.7
Gravity, °API: 31.4
Sulfur, wt %: 0.65
Vis., SSU @ 100° F.: 76.0
Pour pt, °F.: +80
Aniline pt, °F.: 183.0
UOP K factor: 12.1
Carbon residue, wt %: 0.06

**Heavy gas oil**
Range, °F.: 780-1,050
Yield, vol %: 26.4
Gravity, °API: 24.8
Sulfur, wt %: 0.79
Vis., SSU @ 210° F.: 78.3
Pour pt, °F.: +110
Aniline pt, °F.: 202.0
Carbon residue, wt %: 0.28

**Bottoms**
Range, °F.: 1,050+
Yield, vol %: 36.4
Gravity, °API: 11.7
Sulfur, wt %: 1.66
Vis., SSF @ 210° F.: 1,097.8
Carbon residue, wt %: 16.4

## Soviet Export Blend, U.S.S.R.

*Terminals: Ventspils, Baltic and Novorossysk, Black Sea*

**Crude**
Gravity, °API: 32.5
Sulfur, wt %: 1.38
Rvp, kPa: 49.2
Pour pt, °C: −23
Vis. @ 20° C.: 11.5

**Light naphtha**
Range (TBP), °C.: Ibp-90
Yield, wt %: 10.3
Density @ 15° C., g/ml: 0.676
Sulfur, wt %: 0.005
Paraffins, wt %: 71.7
Naphthenes, wt %: 26.5
Aromatics, wt %: 1.8

**Heavy naphtha**
Range (TBP), °C.: 90-180
Yield, wt %: 11.3
Density @ 15 °C., g/ml: 0.761
Sulfur, wt %: 0.029
P/N/A, vol %: 38.5/52.0/9.5

**Kerosine**
Range (TBP), °C.: 180-220
Yield, wt %: 6.5
Density @ 15 °C., g/ml: 0.806
Sulfur, wt %: 0.15
Aromatics, vol %: 20.1
Freeze pt, °C.: −57
Smoke pt, mm: 25
Aniline pt, °C.: 62.5
Vis., cSt @ 20° C.: 1.73

**Light gas oil**
Range (TBP), °C.: 180-350
Yield, wt %: 24.3
Density @ 15° C., g/ml: 0.840
Cetane index (calc.): 49.5
Sulfur, wt %: 0.57
Pour pt, °C.: −29
Aniline pt, °C.: 67.5
Vis., cSt @ 20° C.: 3.69

**Heavy gas oil**
Range (TBP), °C.: 350-515
Yield, wt %: 29.4
Density @ 15° C., g/ml: 0.915
Sulfur, wt %: 1.9
Vis., cSt @ 50° C.: 26.0
V/Ni, ppm: 0.15/0.17

**Long residuum**
Range, °C.: 350
Yield, wt %: 54.1
Density @ 15° C., g/ml: 0.952
Sulfur, wt %: 2.59
Rams. carbon, wt %: 8.2
Vis., cSt @ 50° C.: 191

**Short residuum**
Range, °C.: 515
Yield, wt %: 26.4
Sulfur, wt %: 2.98
Rams. carbon, wt %: 16.4
Vis. @ 60° C.: 3.9
V/Ni, ppm: 154/53

Note: Crude on which this assay was based was shipped from Ventspils. It is claimed that crude from either port is of similar quality.

## Taching (Daqing), China

*Luda (Darien) terminal on Yellow Sea*

**Crude**
Gravity, °API: 33.0
Sulfur, wt%: .078
Pour pt, °F.: +95

**Light ends**
Range, °F.: Ibp-160
Yield, vol %: 1.8

**Light naphtha**
Range, °F.: 160-290
Yield, vol %: 5.4
Sulfur, wt %: 0.0130
Paraffins, vol %: 46.6
Olefins, vol %: 0.4
Naphthenes, vol %: 50.4
Aromatics, vol %: 2.6

**Heavy naphtha**
Range, °F.: 290-390
Yield, vol %: 5.8

Sulfur, wt %: 0.010
P/O/N/A, vol %: 39.6/1.5/52.4/6.5

**Kerosine**
Range, °F.: 390-500
Yield, vol %: 7.7
Gravity, °API: 44.0
Sulfur, wt %: 0.0127
Olefins, vol %: 3.2
Aromatics, vol %: 11.1
Smoke pt, mm: 22
Freezing pt, °F.: −13.9

**Diesel**
Range, °F.: 500-635
Yield, vol %: 7.2
Gravity, °API: 39.2
Sulfur, wt %: 0.0390
Vis., SSU @ 100° F.: 40.2
Pour pt, °F.: +40
Aniline pt, °F.: 178.0
Diesel index: 69.8

**Light gas oil**
Range, °F.: 635-775
Yield, vol %: 16.3
Gravity, °API: 37.0
Sulfur, wt %: 0.0480
Vis., SSU @ 100° F.: 52.1
Pour pt, °F.: +80
Carbon residue, wt %: 0.01

**Heavy gas oil**
Range, °F.: 775-932
Yield, vol %: 18.9
Gravity, °API: 31.4
Sulfur, wt %: 0.1140
Vis., SSU @ 210° F.: 48.1
Pour pt, °F.: +115
UOP K factor: 12.5
Carbon residue, wt%: 0.03

**Bottoms**
Range, °F.: 932+
Yield, vol %: 36.9
Gravity, °API: 21.2
Sulfur, wt %: 0.14
Vis., SSF @ 210° F.: 52.2
Carbon residue, wt %: 7.3
V/Ni, ppm: 1.0/0

## Tapis, Malaysia

*Piped ashore to terminal north of Chukai, Kuala Trengganu area, peninsular Malaysia, as part of Tapis Blend*

**Crude**
Gravity, °API: 44.30
Vis., cSt @ 70° F.: 2.69
Pour pt, °F.: 39
Sulfur, ppm: 230
Total nitrogen, ppm: 134
Basic nitrogen, ppm: 10.1
Neut. no., mg KOH/g: 0.04
Rvp, psi: 2.5
Con. carbon residue, wt %: 2.17
V/Ni, ppm: <0.002/0.17
Wax content, wt %: 5.75
Asphaltene content, wt %: 0.112
Yield, $C_4$ & lighter, vol %: 0.97

**Light gasoline**
Range, °F.: $C_5$-145
Yield, vol %: 2.97
Sulfur, ppm: <5
Rvp, psi: 10.4
RON, clear: 74
RON + 3 cc TEL/U.S. gal: 92.5
Paraffins, wt %: 84.15
Naphthenes, wt %: 13.22
Aromatics, wt %: 2.63

**Heavy naphtha**
Range, °F.: 145-330
Yield, vol %: 23.47
Sulfur, ppm: 13
RON, clear: 53
P/N/A, wt %: 40.26/31.08/28.66

**Kerosine**
Range, °F.: 330-450
Yield, vol %: 20.70
Sulfur, ppm: 23
Freezing pt, °F.: −40
Smoke pt, mm: 20
Cetane index: 55.87
Diesel index: 74

**Light distillate**
Range, °F.: 450-650
Yield, vol %: 34.27
Gravity, °API: 41.0
Sulfur, ppm: 135
Cetane index: 61.9
Aniline pt, °C.: 79.5
Vis., SUS @ 70° F.: 41.35

**Residue**
Range, °F.: 650+
Yield, vol %: 17.62
Gravity, °API: 29.58
Sulfur, ppm: 700
Pour pt, °F.: 108
Con. carbon residue, wt %: 2.024
V/Ni, ppm: 0.31/0.01
Vis., SUS @ 130° F.: 102.31

Note: Tapis is contributor to Tapis Blend

## Tapis Blend, Malaysia

*Piped ashore to terminal north of Chukar, Kuala Trengganu area, peninsular Malaysia*

Tapis Blend comprises oil from six fields in the South China Sea. They are Tapis, Pulai, Bekok, Tiong, Tingge, and Kepong. The latter three fields only recently began contributing to blend and assays had not yet been run at mid 1983. Tapis crude originally made up 60% of blend, Pulai and Bekok 40%. Assays are presented for these three crudes.

## Tembungo, Sabah, Malaysia

*Production platform in offshore producing area*

**Crude**
Gravity, °API: 37.4
Sulfur, wt %: 0.04
Pour pt, °F.: +25
Vis., cSt @ 100° F.: 2.0
Rvp, psi: 2.8
Salt content, lb/1,000 bbl: 2.3

**Light naphtha**
Range, °F.: $C_5$-160
Yield, vol %: 2.4
Gravity, °API: 81.0
Sulfur, wt %: 0.001
Rvp, psi: 12.6
Paraffins, vol %: 83.0
Naphthenes, vol %: 17.0
Aromatics, vol %: Nil

**Heavy naphtha**
Range, °F.: 160-300
Yield, vol %: 17.9
Gravity, °API: 53.0
Sulfur, wt %: 0.004
Paraffins, vol %: 27.0
Naphthenes, vol %: 59.0
Aromatics, vol %: 14.0

**Light distillate**
Range, °F.: 300-510
Yield, vol %: 35.7
Gravity, °API: 36.0
Sulfur, wt %: 0.04
Freeze point, °F.: −45 est.
Smoke pt, mm: 13.0
Paraffins, vol %: 30.0
Naphthenes, vol %: 36.0
Aromatics, vol %: 34.0

**Heavy distillates**
Range, °F.: 510-650
Yield, vol %: 28.9
Gravity, °API: 33.0
Sulfur, wt %: 0.06
Pour pt, °F.: +15.0
Aniline pt, °F.: 153.0
Diesel index: 50.5

**Resid**
Range, °F.: 650+
Yield, vol %: 13.5
Gravity, °API: 25.0
Sulfur, wt %: 0.14
Pour pt, °F.: 85.0
Vis., cSt @ 100° F.: 42.0
Con. carbon, wt %: 0.55

## Udang, Natuna Sea, Indonesia

*Storage vessel with SBM about 43 nautical miles north of Anambas Island*

**Crude**
Gravity, °API: 38.0
Kin. vis. @ 130° F.: 8.71
Con. carbon residue, wt %: 3.0
Sulfur, wt %: 0.05
V/Ni, ppm: 0.9/3.5
Pour pt, °C.: +37.8
Rvp, psi: nil
$C_4$ & lighter, vol %: 0.36

**Naphtha**
Range (TBP), °F.: 90-375
Yield, vol %: 15.2
Gravity, °API: 63.3
Paraffins, vol %: 75.5
Naphthenes, vol %: 20.3
Sulfur, wt %: <0.005

**Kerosine**
Range, °F.: 375-520
Yield, vol %: 11.4
Gravity, °API: 47.7
Sulfur, wt %: 0.005
Aromatics, vol %: 6

**Heavy distillate**
Range, °F.: 520-700
Yield, vol %: 18.7
Gravity, °API: 41.6
Sulfur, wt %: 0.02

**Gas oil**
Range, °F.: 700-1,010
Yield, vol %: 34.6
Gravity, °API: 35.4
Sulfur, wt %: 0.04

**Residue**
Range, °F.: 1,010+
Yield, vol %: 19.7
Gravity, °API: 20.9
Sulfur, wt %: 0.10
Kin. vis. @ 210° F.: 150
Con. carbon residue, wt %: 12.2
V/Ni, ppm: 4/16

## Walio, West Irian, Indonesia

*Kasim marine terminal (CBM) between island of Jef Kasim and mainland Irian Jaya*

**Crude**
Gravity, °API: 34.05
Vis., cSt @ 100° F.: 5.0
Rvp @ 100° C., psi: 3.7
Acid no., mg KOH/g: 0.30
Con. carbon residue, wt %: 2.18
Charac. factor K UOP: 11.7

**Gasoline**
Range, °C.: $C_5$-95
Yield, vol %: 4.5

**Naphtha**
Range, °C.: 95-185
Yield, vol %: 19.0
Paraffins, vol %: 63.3
Naphthenes, vol %: 30.7
Aromatics, vol %: 6.0

**Kerosine**
Range, °C.: 185-260
Yield, vol %: 16.7
Smoke pt, mm: 22.0
Freezing pt, °C.: −46

**Gas oil**
Range, °C.: 260-350
Yield, vol %: 20.0
Diesel index: 56.1

**Fuel oil**
Range, °C.: 350+
Yield, vol %: 39.8
Sulfur, wt %: 1.36
Pour pt, °F.: 100

# Latin America

## BCF 24, Venezuela

*La Salina, Lake Maracaibo*

**Crude**
Gravity, °API: 23.5
Sulfur, wt %: 1.85
Vis., SUS @ 100° F.: 192.2
Pour pt, °F.: −60
Yield, 0°(IVT) - −82° F., vol %: 1.53

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 3.80
Sulfur, wt %: 0.0011
Paraffins, %: 71.37
Naphthenes, %: 26.70
Aromatics, %: 1.93

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 5.0
Sp gr: 0.7565
Sulfur, wt %: 0.0066
P/N/A, %: 48.24/39.87/11.89
RON clear: 65.4

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 2.82
P/N/A, %: 41.95/42.21/15.84

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 3.14
P/N/A, %: 37.59/44.45/17.95
Sulfur, wt %: 0.1186
Freeze pt, °F.: −91.39
Smoke pt, mm: 22.25
Cetane no.: 46.06
Aniline pt, °F.: 128.05

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 7.53
Gravity, °API: 37.37
Sulfur, wt %: 0.3027
Kin. vis. @ 122° F.: 1.51
Freeze pt, °F.: −63.27
Smoke pt, mm: 19.33
Aniline pt, °F: 136.44
Cetane no.: 42.20

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 4.55

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 9.73
Sulfur, wt %: 1.06
Gravity, °API: 29.07
Kin. vis. @ 122° F.: 4.62
Pour pt, °F.: 4.13
Smoke pt, mm: 7.22
Aniline pt, °F.: 150.73

**Residue**
Range, °F.: 650+
Yield, vol %: 61.91
Gravity, °API: 13.26
Sulfur, wt %: 2.58
Kin. vis. @ 122° F.: 2,295
Ni/V, ppm: 40/347

## Bachaquero, Venezuela

*La Salina, Lake Maracaibo*

**Crude**
Gravity, °API: 16.8
Sulfur, wt %: 2.4
Vis., SUS @ 100° F.: 1,362
Pour pt, °F.: −10
Rvp, psi: 1.6
Yield, 0° (IVT) - −82° F., vol %: 0.80

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 2.44
Sulfur, wt %: 0.0075
Paraffins, %: 66.17
Naphthenes, %: 31.28
Aromatics, %: 2.55
RON clear: 71.7

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 3.54
Sulfur, wt %: 0.026
P/N/A, wt %: 29.38/58.96/11.66
RON clear: 66.7

**Naphtha**
Range, °F. 300-350
Yield, vol %: 1.81
Sp gr: 0.8018
Sulfur, wt %: 0.1107
P/N/A, %: 23.20/59.59/17.21

**Kerosine**
Range. °F.:350-400
Yield, vol %: 2.11
Sp gr: 0.8227
Sulfur, wt %: 0.19
P/N/A, %: 25.12/54.49/20.39
Freeze pt, °F.: −74.12
Smoke pt, mm: 17.75
Cetane no.: 48.56

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 6.37
Gravity, °API: 35.43
Sulfur, wt %: 0.52
Aromatics, wt %: 25.29
Freeze pt, °F.: −66.62
Smoke pt, mm: 9.23
Cetane no.: 46.36
Aniline pt., °F.: 127.39
Cetane index: 39.98

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 3.93

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 8.95
Sulfur, wt %: 1.36
Pour pt, °F.: −47.99
Smoke pt, mm: 2.83
Aniline pt, °F.: 138.64

**Residue**
Range, °F.: 650+
Yield, vol %: 70.24
Gravity, °API: 9.39
Sulfur, wt %: 3.0
Kin. vis. @ 122° F.: 8,672
Ni/V, ppm: 74/435

## Boscan, Venezuela

*Bajo Grande, Lake Maracaibo*

**Crude**
Gravity, °API: 10.10
Sulfur, wt %: 5.5
Vis. SUS @ 100° F.: 90,000
Pour pt, °F.: +50

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 0.55

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 1.32
Sulfur, wt %: 0.68
Paraffins, %: 53.28

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 0.88
Sulfur, wt %: 1.28
Paraffins, %: 34.9

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 1.28
Sulfur, wt %: 1.88
Aromatics, %: 24.04
Pour pt, °F.: −141.0
Smoke pt, mm: 16.0
Aniline pt, °F.: 112.69

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 3.96
Gravity, °API: 34.0
Sulfur, wt %: 3.14
Kin. vis. @ 122° F.: 1.81
Pour pt, °F.: −77.53
Smoke pt, °F.: 16.11

Aniline pt, °F.: 113.83
Cetane index: 37.24

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 2.66
Gravity, °API: 28.62
Sulfur, wt %: 4.02

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 6.46
Gravity, °API: 25.54
Sulfur, wt %: 4.47
Pour pt, °F.: −10.9
Cetane no.: 38.0
Aniline pt, °F.: 117.3
Cetane index: 42.27

**Residue**
Range, °F.: 650+
Yield, vol %: 82.9
Sulfur, wt %: 5.86
Gravity, °API: 6.10
Sulfur, wt %: 5.86
Ni/V, ppm: 175/1,407
Kin. vis. @ 122° F.: 22,502

## Ceuta, Venezuela

### *Puerto Miranda, Lake Maracaibo*

**Crude**
Gravity, °API: 31.8
Sulfur, wt %: 1.2
Vis., SUS @ 100° F.: 62
Pour pt, °F.: −35
Rvp: 2.7
Yield, 0°(IVT) - −82° F., vol %: 2.10

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 7.51
Sulfur, wt %: 0.002
Paraffins, %: 75.69
Naphthenes, %: 19.85
Aromatics, %: 4.46
RON clear: 71.5

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 9.89
Sulfur, wt %: 0.01
P/N/A, %: 50.88/32.07/17.05
RON clear: 60.9

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 5.36
P/N/A, %: 42.25/38.78/18.98

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 5.28
Gravity, °API: 44.1
Sulfur, wt %: 0.054
P/N/A, %: 39.8/41.1/19.0
Smoke pt, mm: 21.39
Aniline pt, °F.: 122.8
Cetane index: 40.9

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 9.93
Gravity, °API: 38.75
Sulfur, wt %: 0.33
Aromotics, %: 19.10
Smoke pt, mm: 19.59
Aniline pt, °F.: 136.18
Cetane index: 41.84

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 5.0
Gravity, °API: 34.64
Sulfur, wt %: 0.72

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 9.24
Gravity, °API: 30.17
Sulfur, wt %: 1.0
Aniline pt, °F.: 155.8
Cetane index: 48.03

**Residue**
Range, °F.: 650+
Yield, vol %: 45.69
Gravity, °API: 16.60
Sulfur, wt %: 2.05
Ni/V, ppm: 54/281

## Galeota Mix (Trinidad Blend), Trinidad Tobago

### *Point Galeota SBM*

**Crude**
Gravity, °API: 32.8
Sulfur, wt %: 0.27
Rvp, psi: 2.0
Pour pt, °F.: −5
Neut. no., mg KOH/g: 0.84
Rams. carbon, wt %: 0.5
Kin. vis., cSt @ 100° F.: 4.32
V/Ni, ppm: 0/1
Yield $C_4$ & lighter, vol %: 0.6

**Naphtha**
Range, °F.: $C_5$-200
Yield, vol %: 3.7
Sulfur, wt %: 0.010
Paraffins, vol %: 63.1
Naphthenes, vol %: 30.5
Aromatics, vol %: 6.4
RON clear: 73.1

**Heavy naphtha**
Range, °F.: 200-320
Yield, vol %: 8.7
Sulfur, wt %: 0.017
P/N/A, vol %: 39.4/44.9/15.7
RON clear: 63.8

**Kerosine**
Range, °F.: 320-520
Yield, vol %: 28.8
Gravity, °API: 36.6
Sulfur, wt %: 0.054
Aniline pt, °F.: 126.7
Diesel index: 46.3
Cetane index: 35.6
Freeze pt, °F.: −56
Smoke pt, mm: 20

**Gas oil**
Range, °F.: 520-650
Yield, vol %: 25.6
Gravity, °API: 30.3
Sulfur, wt %: 0.223
Aniline pt, °F.: 151.0
Diesel index: 45.8
Cetane index: 44.6
Pour pt, °F.: 11

**Gas oil**
Range, °F.: 650-850
Yield, vol %: 20.1
Gravity, °API: 26.6
Sulfur, wt %: 0.454
Nitrogen, wt %: 0.030
Vis., SUS @ 122° F.: 77.8

**Residue**
Range, °F.: 650+
Yield, vol %: 32.8
Gravity, °API: 24.2
Sulfur, wt %: 0.607
Pour pt, °F.: +65
Nitrogen, wt %: 0.086
Rams. carbon, wt %: 1.35
Vis., SUS @ 122° F.: 200.3
V/Ni, ppm: 1/1

## Isthmus, Mexico

### *Pajaritos, Veracruz, and Salina Cruz (Pacific), Oaxaca*

**Crude**
Gravity, °API @ 60° F.: 32.8
Sulfur, wt %: 1.51
Pour test, °F.: −15
Vis., SUS @ 70° F.: 65.53
Vis., SUS @ 100° F.: 43.91
Rvp, psi @ 100° F.: 6.4
Hydrogen sulfide, ppm: 102
$NC_4$ & lighter, wt %: 1.2

**Light straight run**
Range, °F.: 60-200
Yield, vol %: 9.1
Total sulfur, wt %: 0.046
RON clear: 62.6
RON + 3 ml TEL/gal: 82.4

**Naphtha**
Range, °F.: 60-400
Yield, vol %: 29.9
Paraffins, vol %: 64.40
Naphthenes, vol %: 21.02
Aromatics, vol %: 14.58
Total sulfur, wt %: 0.054
RON clear: 44.5
RON + 3 ml TEL/gal: 67.0

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 12.5
Gravity, °API: 41.2
Freezing point, °F.: −36
P/N/A, vol %: 47.4/30.9/21.7
Total sulfur, wt %: 0.23
Aniline pt, °F.: 143.2
Smoke pt, mm: 22

**Light gas oil**
Range, °F.: 500-650
Yield, vol %: 16.0
Gravity, °API: 32.3
Pour pt, °F.: +25
P/N/A, vol %: 41.2/33.3/25.5
Total sulfur, wt %: 1.19
Carbon residue, Rams., wt %: 0.01
Aniline pt, °F.: 156.3
Cetane index: 52.5

**Topped crude**
Range, °F.: 650+
Yield, vol %: 40.4
Gravity, °API: 15.5
Vis., SUS @ 210° F.: 145.47
Vis., SUS @ 122° F.: 149.53
Pour pt, °F.: +55
Total sulfur, wt %: 2.94
Carbon residue, Rams., wt %: 8.08
Nitrogen, %: 0.2065
Ni/V, ppm: 14.8/67.1

**Vacuum gas oil**
Range, °F.: 650-1,100+
Yield, vol % (of crude): 28.5
Gravity, °API: 19.7
Aniline pt, °F.: 181.1
Vis., SUS @ 130° F.: 207.09
Pour pt, °F.: +110
Sulfur, wt %: 2.45
Carbon residue, Rams., wt %: 0.97
Ni/V, ppm: 4.3/-

**Vacuum residue**
Range, °F.: 1,100+
Yield, vol % (of crude): 11.9
Gravity, °API: 4.2
Vis., SFS @ 275° F.: 235.8
Sulfur, wt %: 4.18
Carbon residue, wt %: 23.08
Ni/V, ppm: 37/210

## Lagomedio, Venezuela

### *Punta Palmas, Puerto Miranda/La Salina, Lake Maracaibo*

**Crude**
Gravity, °API: 31.50
Sulfur, wt %: 1.17
Vis., SUS @ 100° F.: 56
Pour pt, °F.: −15
Rvp: 5.3
Yield, 0°(IVT) - −82° F., vol %: 1.96

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 6.10
Paraffins, %: 77.35
Naphthenes, %: 20.38
Aromatics, %: 2.28
RON clear: 65.6

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 9.27
Sulfur, wt %: 0.0
P/N/A, %: 55.4/33.0/11.5

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 5.0
P/N/A, %: 50.0/32.5/17.5

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 4.95
Sulfur, wt %: 0.027
Aromatics, %: 19.5
Smoke pt, mm: 24.5
Cetane no.: 56.12
Cetane index: 47.2

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 9.39
Gravity, °API: 40.65
Sulfur, wt %: 0.17
Aromatics, %: 19.7
Smoke pt, mm: 20.61
Cetane no.: 50.02
Aniline pt, °F.: 147.34
Cetane index: 50.3

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 4.69
Gravity, °API: 36.9
Sulfur, wt %: 0.44

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 9.49
Gravity, °API: 33.4
Sulfur, wt %: 0.78
Cetane no.: 54.81
Aniline pt, °F.: 166.46
Cetane index: 58.1

**Residue**
Range, °F.: 650+
Yield, vol %: 49.15
Gravity, °API: 18.16
Sulfur, wt %: 1.97
Ni/V, ppm: 20/180

## La Rosa Medium, Venezuela

### *La Salina, Lake Maracaibo*

**Crude**
Gravity, °API: 25.3
Sulfur, wt %: 1.73
Pour pt, °F.: < −50
Rvp, psi: 4.0
Neut. no., mg KOH/g: 0.90
Vis. kin., cSt @ 122° F.: 24.0
Yield, $C_5$ & lighter: 1.34

**Distillation**

| °F. | | Yield, vol %: |
|---|---|---|
| | On crude | Cum. |
| $C_2$-$C_5$ | 1.34 | 1.34 |
| 158 | 2.47 | 3.80 |
| 212 | 2.33 | 6.13 |
| 302 | 5.40 | 11.52 |
| 401 | 6.69 | 18.21 |
| 509 | 7.81 | 26.01 |
| 650 | 13.22 | 39.23 |
| 698 | 5.63 | 44.85 |
| 752 | 6.33 | 51.17 |
| 752+ | 48.83 | 100.00 |

**Residue**
Range, °F.: 752+
Yield, vol %: 48.83
Gravity, °API: 12.1
Sulfur, wt %: 2.63
Con. carbon, wt %: 12.85
V/Ni, ppm: 413/43
Kin. vis., cSt @ 140° F.: 2,397

## Leona, Venezuela

### *Puerto La Cruz, State of Anzoategui*

**Crude**
Gravity, °API: 24.1
Sulfur, wt %: 1.5
Vis., SUS @ 122° F.: 305
Pour pt, °F.: −45
Rvp: 5.5
Yield, 0°(IVT)-82° F., vol %: 0.99

**Naphtha**
Range, °F.: 82-200
Yield, vol %: 4.34
RON clear: 63.9

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 6.71
Sulfur, wt %: 0.005
Paraffins, %: 49.85
Naphthenes, %: 32.13
Aromatics, %: 18.01

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 3.34

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 3.39
Sulfur, wt %: 0.05
P/N/A, %: 34.6/43.9/21.5
Smoke pt, mm: 18.15
Cetane no.: 44.78
Aniline pt, °F.: 135.13
Cetane index: 43.23

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 10.51
Gravity, °API: 36.39
Sulfur, wt %: 0.19
Smoke pt, mm: 16.14
Cetane no.: 50.18
Aniline pt, °F.: 149.11
Cetane index: 46.50

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 5.31
Sulfur, wt %: 0.56

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 10.32
Gravity, °API: 28.46
Sulfur, wt %: 0.92
Pour pt, °F.: 17.79

**Residue**
Range, °F.: 650+
Yield, vol %: 55.11
Gravity, °API: 12.28
Sulfur, wt %: 2.3
Ni/V, ppm: 26/176

## Loreto, Peru

### *Puerto Bayovar*

**Crude**
Gravity, °API: 34.0
Sulfur, wt %: 0.29
Pour pt, °F.: 34
Vis., SUS @ 80° F.: 53.3
V/Ni, ppm: 63/34

**Light naphtha**
Range, °C.: Ibp-45
Yield, vol %: 2.41

**Naphtha**
Range, °C.: 45-104
Yield, vol %: 7.11
Paraffins, vol %: 68.3
Naphthenes, vol %: 29.9
Aromatics, vol %: 1.8

**Heavy naphtha**
Range, °C.: 104-199
Yield, vol %: 18.24
P/N/A, vol %: 49.9/39.2/10.3

**Kerosine**
Range, °C.: 199-288
Yield, vol %: 18.95
Sulfur, wt %: 0.05
Pour pt, °C.: −37
Cetane index: 46.3

**Residue**
Range, °C.: 343+
Yield, vol %: 41.3
Gravity, °API: 18.9
Sulfur, wt %: 0.51

## Maya, Mexico

### *Pajaritos, Veracruz and Salina Cruz (Pacific), Oaxaca*

**Crude**
Gravity, °API @ 60° F.: 22.0
Sulfur, wt %: 3.32
Pour test, °F.: 0
Vis., SUS @ 70° F.: 1,024.57
Vis., SUS @ 100° F.: 333.62
Rvp, psi @ 100° F.: 4.7
Hydrogen sulfide, ppm: 199
$NC_4$ & lighter, vol %: 1.5

**Light straight run**
Range, °F.: 60-200
Yield, vol %: 5.2
Total sulfur, wt %: 0.025
RON clear: 57.7
RON + 3 ml TEL/gal: 80.9

**Naphtha**
Range, °F.: 60-400
Yield, vol %: 19.7
Paraffins, vol %: 60.60
Naphthenes, vol %: 27.03
Aromatics, vol %: 12.37
Total sulfur, wt %: 0.213
RON clear: 38.1
RON + 3 ml TEL/gal: 57.6

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 9.6
Gravity, °API: 39.6
Freezing pt, °F.: −29
P/N/A, vol %: 45.4/33.7/20.9
Total sulfur, wt %: 1.16
Aniline pt, °F.: 142.2
Smoke pt, mm: 20

**Light gas oil**
Range, °F.: 500-650
Yield, vol %: 12.8
Gravity, °API: 30.6
Pour pt, °F.: +30
P/N/A, vol %: 36.8/34.1/29.1
Total sulfur, wt %: 2.17
Carbon residue, Rams., wt %: 0.08
Aniline pt, °F.: 152.8
Cetane index: 51.0

**Topped crude**
Range, °F.: 650+
Yield, vol %: 56.4
Gravity, °API: 7.7
Vis., SUS @ 210° F.: 3,370.63
Vis., SUS @ 122° F.: 23,755.00
Pour pt, °F.: +115
Total sulfur, wt %: 5.04
Carbon residue, Rams., wt %: 17.83
Nitrogen, %: 0.4245
Ni/V, ppm: 87.8/535.0

**Vacuum gas oil**
Range, °F.: 650-1,100+
Yield, vol % (of crude): 25.2
Gravity, °API: 18.3
Aniline pt, °F.: 167.4
Vis., SUS @ 130° F.: 270.17
Pour pt, °F.: +105
Sulfur, wt %: 3.14
Carbon residue, Rams., wt %: 0.69
Ni/V, ppm: 0.9/1.9

**Vacuum residue**
Range, °F.: 1,100+
Yield, vol % (of crude): 31.2
Gravity, °API: 0.5
Vis., SUS @ 275° F.: Too hard
Sulfur, wt %: 5.78
Carbon residue, Rams., wt %: 26.2
Ni/V, ppm: 149/913

## Merey, Venezuela

### *Puerto La Cruz, State of Anzoategui*

**Crude**
Gravity, °API: 17.4
Sulfur, wt %: 2.2
Vis., SUS @ 100° F.: 1,207
Pour pt, °F.: −10
Yield, 0°(IVT)-82° F., vol %: 0.54

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 1.61
RON clear: 74.7

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 3.21
Sulfur, wt %: 0.01
Paraffins, vol %: 43.9
Naphthenes, vol %: 41.55
Aromatics, vol %: 15.17

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 1.91
Sulfur, wt %: 0.036
P/N/A, vol %: 43.19/42.30/14.50

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 2.37
Sulfur, wt %: 0.09
Aromatics, vol %: 13.95
Smoke pt, mm: 21.37
Aniline pt, °F.: 126.6

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 7.21
Gravity, °API: 34.89
Sulfur, wt %: 0.33
Aromatics, vol %: 17.10
Smoke pt, mm: 13.45
Cetane no.: 35.62
Aniline pt, °F.: 135.51
Cetane index: 38.94

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 4.52
Gravity, °API: 30.82
Sulfur, wt %: 0.7037

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 10.47
Gravity, °API: 27.13
Sulfur, wt %: 1.15

**Residue**
Range, °F.: 650+
Yield, vol %: 68.16
Sulfur, wt %: 2.8
Ni/V, ppm: 74.77/301.08

## Oriente, Ecuador

### *Puerto Balao/ Esmeraldas, Ecuador*

**Crude**
Gravity, °API: 29.2
Sulfur, wt %: 1.01
Vis., cSt @ 104° F.: 13.0
Pour pt, °F.: 25.0
$C_4$ & lighter, vol %: 4.7
Rvp @ 100° F., psi: 3.70
Ni/V, ppm: 39/65

**Light naphtha**
Range, °F.: Ibp-200
Yield, vol %: 3.9
Sulfur, wt %: 0.001
Paraffins, vol %: 62.4
Naphthenes, vol %: 35.0
Aromatics, vol %: 2.6
RON clear: 67.3

**Heavy naphtha**
Range, °F.: 200-400
Yield, vol %: 17.3
Sulfur, wt %: 0.01
P/N/A, vol %: 44.9/45.8/9.3
RON clear: 45.9
Aniline pt, °F.: 130

**Kerosine**
Range, °F.: 400-500
Yield, vol %: 6.4
Gravity, °API: 40.6
Sulfur, wt %: 0.16
Vis., cSt @ 104° F.: 1.78
Smoke pt, mm: 20
Freezing pt, °F.: −41
Aniline pt, °F.: 142

**Gas oil**
Range, °F.: 500-620
Yield, vol %: 14.7
Gravity, °API: 35.1
Sulfur, wt %: 0.49
Vis., cSt @ 104° F.: 3.33
Pour pt, °F.: 5
Aniline pt, °F.: 153

**Vacuum gas oil**
Range, °F.: 620-1,000
Yield, vol %: 32.0
Gravity, °API: 25.2
Sulfur, wt %: 1.14
Vis., cSt @ 104° F.: 33.0
Pour pt, °F.: 90
Ni/V, ppm: 1/<1

**Residue**
Range, °F.: 620+
Yield, vol %: 51.5
Gravity, °API: 17.0
Sulfur, wt %: 1.66
Vis., cSt @ 104° F.: 649
Vis., cSt @ 212° F.: 34.1

## Tia Juana Light, Venezuela

### *La Salina, State of Zulia*

**Crude**
Gravity, °API: 32.1
Sulfur, wt %: 1.1
Kin. vis., SSU @ 100° F.: 60
Pour pt, °F.: −45
Yield, 0°(IVT)-82° F., vol %: 2.16

**Light naphtha**
Range, °F.: 82-200
Yield, vol %: 5.19

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 10.82
Sulfur, wt %: 0.0017
Paraffins, %: 65.99
Naphthenes, %: 24.30
Aromatics, %: 9.71
RON clear: 53.6

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 4.82
Sulfur, wt %: 0.0077
P/N/A, %: 51.23/31.69/17.08

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 4.64
Sulfur, wt %: 0.0281
P/N/A, %: 45.77/35.64/18.58
Smoke pt, mm: 23.37
Aniline pt, °F.: 134.99

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 10.41
Gravity, °API: 40.72
Sulfur, wt %: 0.11
Smoke pt, mm: 14.99
Aniline pt, °F.: 147.31
Cetane index: 50.43

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 4.96
Gravity, °API: 36.17
Sulfur, wt %: 0.4540
Smoke pt, mm: 11.99
Aniline pt, °F.: 158.47

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 9.25
Gravity, °API: 32.39
Sulfur, wt %: 0.78
Smoke pt, mm: 14.42
Aniline pt, °F.: 168.05

**Residue**
Range, °F.: 650+
Yield, vol %: 47.75
Gravity, °API: 16.46
Sulfur, wt %: 1.87
Ni/V, ppm: 26/224

## Tia Juana Pesado (Heavy), Venezuela

*Puerto Miranda, Lake Maracaibo*

**Crude**
Gravity, °API: 12.10
Sulfur, wt %: 2.7
Kin. vis., cSt @ 122° F.: 2,983
Pour pt, °F.: 30
Yield, 0°(IVT)-82° F., vol %: 0.08

**Naphtha**
Range, °F.: 82-200
Yield, vol %: 0.10

**Heavy naphtha**
Range, °F.: 200-300
Yield, vol %: 0.53
Sulfur, wt %: 0.209

**Naphtha**
Range, °F.: 300-350
Yield, vol %: 0.52
Sulfur, wt %: 0.21

**Kerosine**
Range, °F.: 350-400
Yield, vol %: 0.90
Sulfur, wt %: 0.24
Aromatics, %: 13.31
Smoke pt, mm: 20.53
Aniline pt, °F.: 122.34

**Gas oil**
Range, °F.: 400-500
Yield, vol %: 4.52
Gravity, °API: 31.9
Sulfur, wt %: 0.6
Smoke pt, mm: 13.26
Aniline pt, °F.: 128.0
Cetane no.: 32.46
Cetane index: 33.27

**Gas oil**
Range, °F.: 500-550
Yield, vol %: 3.12
Sulfur, wt %: 0.93

**Gas oil**
Range, °F.: 550-650
Yield, vol %: 7.92
Gravity, °API: 22.96
Sulfur, wt %: 1.51

**Residue**
Range, °F.: 650+
Yield, vol %: 82.15
Gravity, °API: 8.94
Sulfur, wt %: 3.0
V, ppm: 532

## Bombay High, India

*Floating storage in Arabian Sea producing area*

**Crude**
Gravity, °API: 39.35
Rvp @ 38° C., kg/sq cm: 0.34
Pour pt, °C.: +30
Kin. vis., cSt @ 40° C.: 3.28
Sulfur, wt %: 0.17
Salt content, lb/1,000 bbl: 11
Con. carbon, wt %: 1.2
Wax (E.H.), wt %: 10.6

Yield, vol %: 20.6
Gravity, °API: 58.42
Charac. factor K UOP: 11.7
V/Ni/Fe, ppm: 0.3/1.0/<0.3

**Naphtha**
Range, °C.: $C_5$–150
Yield, wt %: 18.6
Rvp, Kg/sq cm @ 38° C.: 0.42
Sulfur, total, ppm: 3.0
Mercaptan sulfur, ppm: 1.3
Paraffins, vol %: 53.7
Napthenes, vol %: 25.0
Aromatics, vol %: 21.3
RON, clear: 69.6
RON + 0.56 g Pb/l as TEL: 82.1

**Kerosine**
Range, °C.: 140–240
Yield, wt %: 19.3
Yield, vol %: 19.6
Gravity, °API: 43.75
Sulfur, total, ppm: 66
Mercaptan sulfur, ppm: 1.5
Flash pt, (Abel), °C.: 46.5
Smoke pt, mm: 19
Freezing pt, °C.: − 54.0
Aniline pt, °C.: 52.2
Kin. vis., cSt @ − 30° C.: 4.18
P/N/A, vol %: 39.8/23.9/26.3

**Gas oil**
Range, °C.: 240–370
Yield, wt %: 25.6
Yield, vol %: 25.2
Gravity, °API: 34.25
Pour pt, °C.: + 3
Kin. vis., cSt @ 37.8° C.: 4.17
Sulfur, total, wt %: 0.14
Aniline pt, °C.: 73.2
Diesel index: 56

**Vacuum gas oil**
Range, °C.: 370–550
Yield, wt %: 29.3
Yield, vol %: 27.5
Gravity, °API: 29.86
Pour pt, °C.: + 51
Kin. vis., cSt @ 70° C.: 11.0
Kin. vis., cSt @ 98.9° C.: 5.65
Con. carbon, wt %: 0.17
Asphaltene, wt %: 0.06
V/Ni/Cu/Fe, ppm: <0.3/<0.3/<0.1/<0.3

**Residue**
Range, °C.: 370+
Yield, wt %: 34.6
Yield, vol %: 31.0
Gravity, °API: 21.24
Pour pt, °C.: + 51
Sulfur, total, wt %: 0.38
Kin. vis., cSt @ 98.9° C.: 14.37
Kin. vis., cSt @ 70° C.: 24.66
Con. carbon, wt %: 4.33
Asphaltene, wt %: 1.22
V/Ni/Cu/Fe, ppm: 0.8/2.8/<0.1/0.35

**Residue**
Range, °C.: 550+
Yield, wt %: 5.3
Yield, vol %: 3.5
Gravity, °API: 7.86
Pour pt, °C.: +78
Sulfur, total, wt %: 0.77
Kin. vis., cSt @ 98.9° C.: 1,396.58
Con. carbon, wt %: 23.70
Asphaltene, wt %: 8.40
V/Ni/Cu/Fe, ppm: 5.0/18.0/<0.1/1.9

# North America

## Bow River Heavy, Alberta

*Bow River Pipe Lines Ltd. to Edmonton**

**Crude**
Gravity, °API: 26.7
Sulfur, g/kg: 21.0
Rvp, kPa: 37.2
Pour pt, °C.: −50.0
Con. carbon, wt %: 6.70
Vis., cSt @ 40° C.: 18.30
Ni/V, wt ppm: 20.7/54.0
$C_3$, yield, vol %: 0.41
$C_4$s, yield, vol %: 1.47

**Naphtha**
Range, °C.: $C_5$-190
Yield, vol %: 20.40
Sulfur, g/kg: 0.61
Paraffins, vol %: 65.50
Olefins, vol %: 0.40
Naphthenes, vol %: 26.80
Aromatics, vol %: 7.30

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 13.10
Sulfur, g/kg: 4.40
P/O/N/A, vol %: 73.20/2.60/0.00/24.20
Aniline pt, °C.: 57.7
Pour pt, °C.: −60.6
Cetane no.: 44.0
Cetane index: 52.3
Smoke pt, mm: 27.0

**Distillate**
Range, °C.: 277-343
Yield, vol %: 10.80
Gravity, °API: 29.6
Sulfur, g/kg: 10.30
Aromatics, vol %: 55.10
Aniline pt, °C.: 63.9
Pour pt, °C.: − 35.0
Cetane no.: 46.0
Cetane index: 49.6
Vis., cSt @ 38° C.: 5.57

**Gas oil**
Range, °C.: 343-565°
Yield, vol %: 32.50
Gravity, °API: 20.9
Sulfur, g/kg: 21.00
Total nitrogen, wt %: 0.03
Pour pt, °C.: 12.1
Con. carbon, wt %: 0.60
Vis. cSt @ 38° C.: 57.30
Ni/V, ppm: 0.00/0.12

**Residue**
Range, °C.: 565+
Yield, vol %: 23.20
Gravity, °API: 5.3
Sulfur, g/kg: 38.20
Pour pt, °C.: 73.0
Vis., cSt @ 135° C.: 940
Penetration @ 25° C.: 19
Ni/V, wt ppm: 67.70/169.00

*Has access to Interprovincial and Trans Mountain pipelines at Edmonton

## Cold Lake,* Alberta

*Alberta Oil Sands Pipeline Ltd. to Edmonton†*

**Crude**
Density, g/cu cm: 0.9031
Sulfur, wt %: 2.91
Vis., cSt @ 15° C.: 70.7

Neut. No.: 0.71
Nitrogen, wt %: 0.29
Pour pt, °C.: − 60
$C_5$ & lighter yield, vol %: 7.43

**Naphtha**
Range, °C.: 20-175
Yield, vol %: 30.0
RON clear: 63.7
Sulfur, wt %: 0.06

**Distillate**
Range, °C.: 175-295
Yield, vol %: 10.5
Density, kg/cu cm: 0.7983
Sulfur, wt %: 0.76
Aniline pt, °C.: 56
Vis., cSt @ 40° C.: 2.0
Freezing pt, °C.: − 61.5
Pour pt, °C.: − 51
Smoke pt, °C.: 18.4

**Gas oil**
Range, °C.: 343-517
Yield, vol %: 18.7
Density, kg/cu cm @ 15° C.: 0.9536
Sulfur, wt %: 2.96
Nitrogen, wt %: 0.08
Ni/V, wt ppm: 0.05/0.15

**Residium**
Range, °C.: 343+
Yield, vol %: 51.6
Density, kg/cu cm: 1.0203
Sulfur, wt %: 4.8
Vis., cSt @ 60° C.: 7,750
Pour pt, °C.: +51
Ni/V/Fe, wt ppm: 90.6/213.7/12.8

**Asphalt**
Range, °C.: 405+
Yield, vol %: 47.8
Density @ 15° C., kg/cu m: 1,030.7
Pen. @ 25° C. (100/5): 343
Pen. @ 4° C. (100/5): 36
Pen. index: − 1.01
Vis. @ 60° C., Poises: 298
Vis. @ 100° C., cSt: 994

**Asphalt**
Range, °C.: 470+
Yield, vol %: 37.7
Density @ 15° C., kg/cu m: 1,046.9
Pen. @ 25° C. (100/5): 60
Pen. @ 4° C. (100/5): 6
Pen. index: − 0.46
Vis. @ 60° C., Poises: 3,576
Vis. @ 100° C., cSt: 4,894

*Diluent added to crude to permit pipeline transportation. This assay made on blend of 28 wt % mixed condensate (gravity, °API, 58.9) and 72 wt % Cold Lake Crude that had the following characteristics:

Gravity, °API: 13.2
Density @ 15° C.: 0.9770
Sulfur, wt %: 4.11
Nitrogen, wt %: 0.42
Pour pt, °C.: − 4
Vis., cSt @ 40° C.: 1,057
Vis., cSt @ 80° C.: 98

†Has access to Interprovincial and Trans Mountain pipelines at Edmonton

## Federated Light and Medium, Alberta

### *Federated Pipe Line Ltd. to Edmonton**

**Crude**
Gravity, °API: 39.7
Sulfur, g/kg: 2.01
Total nitrogen, wt %: 0.11
Rvp, kPa: 31.0
Pour pt, °C.: − 10.0
Con. carbon, wt %: 1.46
Vis. cSt @ 40° C.: 3.30
Wax, wt %: 9.12
Neut. value, mg: 0.00
Ni/V, ppm: 0.07/0.00
$C_4$ & lighter, vol %: 3.43

**Naphtha**
Range, °C.: $C_5$-190
Yield, vol %: 30.90
Sulfur, g/kg: 0.05
Paraffins, vol %: 28.30
Naphthenes, vol %: 54.90
Aromatics, vol %: 16.80
RON clear: 56.4

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 18.25
Gravity, °API: 41.0
Sulfur, g/kg: 0.68
Aromatics, vol %: 23.00
Aniline pt, °C.: 142.0
Pour pt, °C.: − 40.0
Freezing pt, °C.: − 39.0
Cetane no.: 47.0

**Distillate**
Range, °C.: 277-343
Yield, vol %: 13.73
Gravity, °API: 34.6
Sulfur, g/kg: 1.97
Aniline pt, °C.: 80.7
Pour pt, °C.: − 7.5
Cetane no.: 55.0
Cetane index: 49.0
Vis., cSt @ 38° C.: 4.43

**Gas oil**
Range, °C.: 343-565
Yield, vol %: 28.29
Gravity, °API: 25.6
Sulfur, g/kg: 3.10
Total nitrogen, wt %: 0.16
Pour pt, °C.: 40.0
Con. carbon, wt %: 0.45
Vis., cSt @ 50° C.: 29.32
Ni/V, wt ppm: 1.24/0.00

**Residue**
Range, °C.: 565+
Yield, vol %: 8.83
Gravity, °API: 15.2
Sulfur, g/kg: 5.40
Pour pt, °C.: 26.0
Vis., cSt @ 135° C.: 30.64
Ni/V, wt ppm: 9.50/5.70

*Has access to Interprovincial and Trans Mountain pipelines at Edmonton.

## Gulf Alberta, L & M

### *Gulf Alberta Pipeline to Edmonton**

**Crude**
Gravity, °API: 35.1
Sulfur, g/kg: 9.80
$H_2S$, wt ppm: 58.1
Rvp, kPa: 36.4
Pour pt, °C.: − 27.5
Vis., cSt @ 40° C.: 4.86
Ni/V, wt ppm: 10.10/9.00
$C_4$ & lighter, yield, vol %: 3.50

**Naphtha**
Range, °C.: $C_5$-190
Yield, vol %: 30.60
Sulfur, g/kg: 0.36
Paraffins, vol %: 56.04
Olefins, vol %: 0.00
Naphthenes, vol %: 31.53
Aromatics, vol %: 12.43

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 14.20
Gravity, °API: 39.9
Sulfur, g/kg: 2.76
Aromatics, vol %: 28.13
Aniline pt, °C.: 59.7
Pour pt, °C.: − 40.0
Cetane no.: 46.0
Cetane index: 49.0
Smoke pt, mm: 19.0

**Distillate**
Range, °C.: 277-343
Yield, vol %: 8.53
Gravity, °API: 22.1
Sulfur, g/kg: 7.67
Aniline pt, °C.: 70.0
Pour pt, °C.: − 10.0
Cetane no.: 52.0
Cetane index: 55.0
Vis., cSt @ 38° C.: 5.14

**Gas oil**
Range, °C.: 343-565
Yield, vol %: 31.43
Gravity, °API: 23.8
Sulfur, g/kg: 12.72
Total nitrogen, wt %: 0.13
Pour pt, °C.: 31.0
Con. carbon, wt %: 0.23
Vis., cSt @ 38° C.: 44.22
Ni/V, ppm: 0.40/0.00

**Residue**
Range, °C.: 565+
Yield, vol %: 15.2
Gravity, °API: 14.6
Sulfur, g/kg: 23.87
Pour pt, °C.: 44.0
Vis., cSt @ 135° C.: 59.97
Ni/V, wt ppm: 24.10/25.10

*Access to Interprovincial and Trans Mountain pipelines at Edmonton.

## Lloydminster,* Alberta and Saskatchewan

### *Husky Oil Operations Ltd. pipeline to Hardisty, Alta.†*

**Crude**
Gravity, °API: 20.7
Sulfur, g/kg: 31.5
Rvp, kPa: 30.3
Pour pt, °C.: − 32.0
Con. carbon, wt %: 9.18
Vis., cSt @ 40° C.: 101.00
Neut. value, mg: 0.78
Ni/V, wt ppm: 52.70/10.50
$C_4$ & lighter, yield, vol %: 0.48

**Naphtha**
Range: $C_5$-190°
Yield, vol %: 19.50
Sulfur, g/kg: 0.79
Paraffins, vol %: 55.10
Olefins, vol %: 1.50
Naphthenes, vol %: 31.60
Aromatics, vol %: 11.80

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 9.80
Gravity, °API: 34.9
Sulfur, g/kg: 5.05
Aromatics, vol %: 22.40
Aniline pt, °C.: 52.4
Pour pt, °C.: − 63.3
Cetane no.: 35.0
Smoke pt, mm: 19.0

**Distillate**
Range, °C.: 277-343
Yield, vol %: 9.50

Gravity, °API: 26.5
Sulfur, g/kg: 8.45
Aromatics, vol %: 38.90
Aniline pt, °C.: 56.5
Pour pt, °C.: – 31.1
Cetane no.: 40.0
Cetane index: 41.5
Vis., cSt @ 38° C.: 6.32

**Gas oil**
Range, °C.: 343-565
Yield, vol %: 25.20
Gravity, °API: 17.5
Sulfur, g/kg: 28.50
Aniline pt, °C.: 72.2
Pour pt, °C.: 1.7
Con. carbon, wt %: 0.55
Vis., cSt @ 38° C.: 155.00
Ni/V, wt ppm: 0.00/0.10

**Residue**
Range, °C.: 565+
Yield, vol %: 36.00
Gravity, °API: 2.9
Sulfur, g/kg: 56.90
Pour pt, °C.: 69.0
Con. carbon, wt %: 25.10
Vis., cSt @ 135° C.: 3,260
Ni/V, wt ppm: 123/231

*Crude has been blended with pipeline condensate to permit transportation. Typically 20-25% condensate is added to crude.
†Has access to Interprovincial pipeline at Hardisty.

## Rainbow Light and Medium, Alberta

### Rainbow Pipe Line Co. Ltd. to Edmonton*

**Crude**
Gravity, °API: 40.7
Sulfur, g/kg: 5.00
$H_2S$, wt ppm: 10.2
Rvp, kPa: 33.9
Pour pt, °C.: 2.5
Con. carbon, wt %: 1.65
Vis., cSt @ 40° C.: 3.77
Wax, wt %: 20.40
Neut. value, mg: 0.08
Ni/V, wt ppm: 0.85/0.50
$C_4$ & lighter, yield, vol %: 3.40

**Naphtha**
Range, °C.: $C_5$-190
Yield, vol %: 38.70
Sulfur, g/kg: 0.14
Paraffins, vol %: 61.25
Naphthenes, vol %: 25.96
Aromatics, vol %: 12.79
RON clear: 51.2
MON clear: 51.4

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 13.00
Gravity, °API: 42.2
Sulfur, g/kg: 1.20
Aromatics, vol %: 24.23
Aniline pt, °C.: 62.3
Pour pt, °C.: – 37.5
Freezing pt, °C.: – 35.0
Cetane no.: 46.0
Cetane index: 47.8
Smoke pt, mm: 20.0
Vis., cSt @ 40° C.: 1.55

**Distillate**
Range, °C.: 277-343
Yield, vol %: 11.50
Gravity, °API: 35.0
Sulfur, g/kg: 4.40
Aniline pt. °C.: 75.5
Pour pt, °C.: – 5.0
Cetane no.: 59.0
Cetane index: 55.0
Vis., cSt @ 38° C.: 4.51

**Gas oil**
Range, °C.: 343-565
Yield, vol %: 31.65
Sulfur, g/kg: 8.04
Total nitrogen, wt %: 0.69
Pour pt, °C.: 26.0
Con. carbon, wt %: 0.16
Vis., cSt @ 50° C.: 20.39
Asphaltenes, vol %: 4.10
Ni/V, wt ppm: 0.02/0.00

**Residue**
Range, °C.: 565+
Yield, vol %: 5.15
Gravity, °API: 19.6
Sulfur, g/kg: 10.71
Total nitrogen, wt %: 3.22
Pour pt, °C.: 28.0
Con. carbon, wt %: 11.11
Vis., cSt @ 135° C.: 27.82
Asphaltenes, wt %: 13.42
Ni/V, wt ppm: 4.60/2.90

*Has access to Interprovincial and Trans Mountain pipelines at Edmonton.

## Rangeland-South L & M, Alberta

### Rangeland Pipe Line Co. to Canadian/U.S. border near Carway, Alta.

**Crude**
Gravity, °API: 39.5
Sulfur, g/kg: 7.52
$H_2S$, wt ppm: 20.1
Rvp, kPa: 39.3
Pour pt, °C.: – 40.0
Con. carbon, wt %: 0.69
Vis., cSt @ 40° C.: 2.67
Wax, wt %: 12.44
Neut. value, mg: 0.12
Ni/V, wt ppm: 1.20/1.[illegible]0
$C_4$ & lighter, yield, wt %: 3.22

**Naphtha**
Range, °C.: $C_5$-190
Yield, vol %: 38.75
Sulfur, g/kg: 0.12
Rvp, kPa: 41.1
Paraffins, vol %: 42.45
Naphthenes, vol %: 36.86
Aromatics, vol %: 20.69
RON clear: 58.5
MON clear: 57.3

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 15.50
Gravity, °API: 38.3
Sulfur, g/kg: 1.87
Aromatics, vol %: 24.0
Aniline pt, °C.: 62.0
Pour pt, °C.: – 37.5
Freezing pt, °C.: – 28.5
Cetane no.: 48.0
Smoke pt, mm: 20.0

**Distillate**
Range, °C.: 277-343
Yield, vol %: 8.55
Gravity, °API: 32.0
Sulfur, g/kg: 4.79
Aniline pt, °C.: 71.0
Pour pt, °C.: – 7.5
Cetane no.: 51.0
Cetane index: 52.0
Vis., cSt @ 38° C.: 5.24

**Gas oil**
Range, °C.: 343-565
Yield, vol %: 33.20
Gravity, °API: 26.5
Sulfur, g/kg: 11.64
Total nitrogen, wt %: 0.62
Aniline pt, °C.: 86.6
Pour pt, °C.: 24.0
Con. carbon, wt %: 0.10
Vis., cSt @ 38° C.: 42.02

**Residue**
Range, °C.: 565+
Yield, vol %: 4.0
Gravity, °API: 21.7
Sulfur, g/kg: 12.19
Pour pt, °C.: 27.5
Vis., cSt @ 135° C.: 18.75
Asphaltenes, wt %: 10.13
Ni/V, wt ppm: 3.0/7.4

## Wainwright—Kinsella,* Alberta

### Husky Oil Operations Ltd. pipeline to Hardisty, Alta.†

**Crude**
Gravity, °API: 23.1
Sulfur, g/kg: 15.80
Rvp, kPa: 30.3
Pour pt, °C.: – 39.0
Con. carbon, wt %: 6.70
Vis., cSt @ 40° C.: 32.50
Ni/V, ppm: 40.30/79.90

**Naphtha**
Range, °C: $C_5$-190
Yield, vol %: 19.0
Sulfur, g/kg: 0.50
Paraffins, vol %: 52.50
Naphthenes, vol %: 37.80
Aromatics, vol %: 8.90

**Kerosine**
Range, °C.: 190-277
Yield, vol %: 12.00
Gravity, °API: 36.3
Sulfur, g/kg: 3.44
Aromatics, vol %: 22.80
Aniline pt, °C.: 56.7
Freezing pt, °C.: – 51.6
Cetane no.: 37.0
Smoke pt, mm: 26.0

**Distillate**
Range, °C.: 277-343
Yield, vol %: 11.0
Gravity, °API: 28.1
Sulfur, g/kg: 10.50
Aromatics, vol %: 33.70
Aniline pt, °C.: 60.5
Pour pt, °C.: – 22.0
Cetane no.: 42.0
Cetane index: 43.9
Vis., cSt @ 38° C.: 5.69

**Gas oil**
Range, °C.: 343-565
Yield, vol %: 26.00
Gravity, °API: 19.1
Sulfur, g/kg: 21.80
Total nitrogen, wt %: 0.03
Pour pt, °C.: 12.8
Vis., cSt @ 38° C.: 131.0
Con. carbon, wt %: 0.55
Ni/V, wt ppm: 0.11/0.00

**Residue**
Range, °C.: 565+
Yield, vol %: 32.0
Gravity, °API: 3.7
Sulfur, g/kg: 52.60
Pour pt, °C.: 74.0
Vis., cSt @ 135° C.: 212.00
Asphaltenes, wt %: 19.10
Ni/V, ppm: 110/222

*Note: crude blended with condensate to permit transportation.
†Has access to Interprovincial Pipeline.

# U.S.

## Alaska North Slope (ANS, Sadlerochit)

*Trans Alaska Pipeline to Valdez Terminal*

**Crude**
Gravity, °API: 26.4
Sulfur, wt %: 1.06
Pour pt, °F.: 0
Rvp, psi: 3.55
Kin. vis. @ 60° F.: 42.42
$H_2S$, lb/1,000 bbl: 0.35
Salt, lb/1,000 bbl: 32.7
Carbon residue, wt %: 4.40
Neut. no. (D974): 1.12
Ni/V, ppm: 11/26
Nitrogen, ppm: 2,090
$C_4$ & lighter, yield, vol %: 1.17

**Light gasoline**
Range, °F.: $C_5$—150
Yield, vol %: 2.2
Sulfur, wt %: <0.001
RON clear: 71.5
MON clear: 69.8
RON + 0.5g TEL/gal: 78.4

**Naphtha**
Range, °F.: 150—380
Yield, vol %: 15.6
Sulfur, wt %: 0.013
Paraffins, vol %: 39.7
Naphthenes, vol %: 43.3
Aromatics, vol %: 17.0

**Distillate**
Range, °F.: 380—650
Yield, vol %: 28.6
Gravity, °API: 33.1
Sulfur, wt %: 0.414
Pour pt, °F.: − 25
Cetane No.: 45.8
Total $N_2$, ppm: 79
Aromatics, vol %: 33.6

**Blended gas oil**
Range, °F.: 650—840
Yield, vol %: 16.4
Gravity, °API: 23.8
Sulfur, wt %: 1.10
Aniline pt, °C.: 74.7
Pour pt, °F.: 70
Carbon residue, %: 0.012
Total nitrogen, ppm: 950
Basic nitrogen: 0.03

**Residue**
Range, °F.: 650+
Yield, vol %: 52.4
Gravity, °API: 15.0
Sulfur, wt %: 1.63
Carbon residue, %: 8.82
Total nitrogen, ppm: 3,600
Pour pt, °F.: 80
Kin. vis. @ 210° F.: 47.54
Kin. vis. @ 275° F.: 15.55

Note: This assay is of Sadlerochit crude, originally the only component of North Slope crude. Kuparuk crude is now blended at a rate of about 120,000 b/d with Sadlerochit at pumpstation No. 1. Total ANS stream is about 1.6 million b/d. See Kuparuk analysis in this section.

## Kuparuk,* Alaska

*Trans Alaska Pipeline to Valdez Terminal*

**Crude**
Gravity, °API: 23.0
Sulfur, wt %: 1.76
Pour pt, °F.: − 55
Rvp, psi: 2.6
Kin. vis. @ 60° F., cSt: 79.98
$H_2S$, lb/1,000 bbl: <5
Carbon residue, wt %: 7.37
Ni/V, ppm: 19/57
Nitrogen, ppm: 1,980
$C_5$ & lighter, vol %: 2.12

**Light gasoline**
Range (TBP), °F.: $C_5$—150
Yield, vol %: 1.6
Sulfur, wt %: 0.006

**Naphtha**
Range, °F.: 150—380
Yield, vol %: 14.5
Sulfur, wt %: 0.018
Paraffins, vol %: 38.3
Naphthenes, vol %: 47.0
Aromatics, vol %: 14.7

**Distillate**
Range, °F.: 380—650
Yield, vol %: 26.9
Sulfur, wt %: 0.66
Pour pt, °F.: − 25
Cetane No.: 45.4
Vis., cSt @ 100° F.: 3.083
Aromatics, wt %: 30.0

**Gas oil**
Range, °F.: 650—840
Yield, vol %: 18.9
Gravity, °API: 20.5
Sulfur, wt %: 1.79
Aniline pt, °C.: 104.3
Pour pt, °F.: 50
Kin. vis. @ 100° F.: 34.20
Carbon residue, wt %: 0.01
Total nitrogen, ppm: 600
Basic nitrogen, wt %: 0.02
V/Ni, ppm: <1

**Residue**
Range, °F.: 650+
Yield, vol %: 56.0
Gravity, °API: 11.7
Sulfur, wt %: 2.59
Carbon residue, wt %: 12.61
Pour pt, °F.: 40
Kin. vis. @ 210° F.: 97.15

*About 120,000 b/d of Kuparuk is blended with some 1.6 million b/d of Sadlerochit crude to produce North Slope crude. Kuparuk contribution is expected to double by early 1985.

## West Sak,* Alaska

*Not in production*

**Crude**
Gravity, °API: 22.4
Sulfur, wt %: 1.82
Pour pt, °F.: − 50
Rvp, psi: 2.70
Kin. vis. @ 60° F.: 95.92
Carbon residue, wt %: 7.62
Ni/V, ppm: 22/61
Neut. no. (D974): 0.68
$C_4$ & lighter, yield, vol %: 0.63

**Light gasoline**
Range, °F.: $C_5$—150
Yield, vol %: 1.9
Sulfur, wt %: 0.004

**Naphtha**
Range, °F.: 150—380
Yield, vol %: 14.4
Sulfur, wt %: 0.018
Paraffins, vol %: 36.4
Naphthenes, vol %: 48.2
Aromatics, vol %: 15.4

**Distillate**
Range, °F.: 380—650
Yield, vol %: 27.5
Gravity, °API: 31.6
Sulfur, wt %: 0.700
Pour pt, °F.: − 35
Cetane no.: 42.1
Aromatics, vol %: 31.4
Vis., cSt @ 100° F.: 3.34

**Gas oil**
Range, °F.: 650—840
Yield, vol %: 16.6
Gravity, °API: 21.1
Sulfur, wt %: 1.81
Pour pt, °F.: 60
Kin. vis. @ 100° F.: 43.99
Total nitrogen, ppm: 840
Basic nitrogen: 0.023

**Residue**
Range, °F.: 650+
Yield, vol %: 55.6
Gravity, °API: 10.8
Sulfur, wt %: 2.53
Carbon residue, wt %: 13.15
Pour pt, °F.: 45
Kin. vis. @ 210° F.: 135.3
Pentane insoluble, wt %: 14.97

*Crude not in production, but pilot program is underway in Kuparuk area to determine feasibility. Assay sample obtained during drill stem test.

# Crude oil streams by country of origin*

**Abu Dhabi, U.A.E.**
Abu Al Bu Khoosh—Cie. Francaise des Petroles
Murban—Abu Dhabi National Oil Co.
Umm Shaif (Abu Dhabi Marine)—Adnoc
Zakum (Lower Zakum)—Adnoc

**Algeria**
Saharan Blend—Sonatrach
Zarzaitine—Sonatrach

**Angola**
Cabinda—Cabinda Gulf Oil Co.
Soyo Blend—Cia. de Petroles de Angola and Texaco Angola

**Brunei**
Champion Export—Brunei Shell
Seria Light—Brunei Shell

**Cameroon**
Kole Marine Blend—Elf Serepca

**Canada**
Bow River Heavy—Alberta Petroleum Marketing Commission
Cold Lake—Esso Petroleum Canada/APMC
Federated—APMC/Home Oil Ltd.
Gulf Alberta L & M—APMC/Gulf Canada
LLoydminster—Husky Oil Operations Ltd.
Rainbow Light & Medium—APMC/Mobil Oil Canada
Rangeland South—APMC/Dome Petroleum Ltd.
Wainwright-Kinsella—APMC/Husky Oil Operations Ltd.

**China**
Shengli—Petroleum Corp. of PRC
Taching (Daqing)—Petroleum Corp. of PRC

**Congo (Brazzaville)**
Djeno Blend (Djeno Melange)—Elf Congo

**Denmark**
Dan—Dansk Undergrunds Consortium (DUC)
Gorm—DUC

**Divided Zone**
Burgan (Wafra)—Getty and Kuwait Oil Co.
Eocene (Wafra)—Getty and Kuwait Oil Co.
Hout—Arabian Oil Co.
Khafji—AOC

**Dubai, U.A.E**
Dubai (Fateh)—Dubai Petroleum Co.

**Ecuador**
Oriente—Texaco

**Egypt**
Belayim—AGIP
Gulf of Suez Mix—Amoco

**Gabon**
Gamba—Elf Gabon
Lucina Marine—Elf Gabon
Mandji—Elf Gabon

**Ghana**
Salt Pond—Agri-Petco

**India**
Bombay High—Oil & Natural Gas Commission

**Indonesia**
Ardjuna—Atlantic Richfield Indonesia Inc.
Arimbi—ARCO Indonesia
Attaka—Union Oil Co. of Indonesia
Badak—Roy M. Huffington Inc.
Bekapai—Total Indonesie
Bunyu—Pertamina
Cinta—Independent Indonesian American Petroleum Co.
Duri (Sumatran Heavy)—Caltex Pacific Indonesia
Handil—Total Indonesie
Jatibarang—Pertamina
Minas (Sumatran Light)—Caltex Pacific Indonesia
Salawati—Phillips Petroleum Co., Indonesia
Sanga Sanga—Tesoro
Sepinggan—Yakin Mixed (4:1)—Union Oil Co. of Indonesia
Udang—Conoco of Indonesia
Walio—Petromer Trend Corp.

**Iran**
Aboozar (Ardeshir)—National Iranian Oil Co.
Bahrgansar/Nowruz (Sirip Blend)—NIOC
Dorrood (Darius)—NIOC
Foroozan (Fereidoon)—NIOC
Iranian Heavy—NIOC
Iranian Light—NIOC
Rostam—NIOC
Salmon (Sassan)—NIOC
Sirri—NIOC
Soroosh (Cyrus), Iran—NIOC

**Iraq**
Basrah Heavy—Iraq National Oil Co.
Basrah Light—INOC
Basrah Medium—INOC
Kirkuk Blend—INOC

**Ivory Coast**
Espoir—Phillips Petroleum Co. Ivory Coast

**Kuwait**
Kuwait—Kuwait Oil Co.

**Libya**
Amna (high pour)—Libyan National Oil Corp.
Brega—LNOC
Bu Attifel—AGIP
Es Sider—Oasis
Sarir—LNOC
Sirtica—LNOC
Zueitina—Occidental

**Malaysia**
Bekok—Esso Malaysia
Bintulu—Shell Malaysia
Labuan Blend—Shell Malaysia
Miri Light—Shell Malaysia
Pulai—Esso Malaysia
Tapis—Esso Malaysia
Tapis Blend—Esso Malaysia
Tembungo—Esso Malaysia

**Mexico**
Isthmus—Pemex
Maya—Pemex

**Nigeria**
Bonny Light—Shell
Bonny Medium—Shell
Brass River—Phillips Oil Co. (Nigeria)
Escravos—Gulf Oil Co. (Nigeria)
Forcados Blend—Shell
Pennington—Texaco Overseas (Nigeria)
Qua Iboe (Nigerian Light)—Mobil Oil Nigeria

**Norway**
Ekofisk—Phillips Petroleum
Gullfaks—Statoil
Murchison—Conoco
Statfjord—Mobil

**Oman**
Oman Export—Petroleum Development (Oman) Ltd. and Elf Group

**Qatar**
Dukhan (Qatar land)—Qatar General Petroleum Corp.
Qatar Marine—QGPC

**Saudi Arabia**
Arabian Heavy (Safaniya)—Arabian American Oil Co.
Arabian Light—Aramco
Arabian Light (Berri)—Aramco
Arabian Medium (Khursaniyah)—Aramco
Arabian Medium (Zuluf/Marjan)—Aramco

**Sharjah, U.A.E**
Mubarek—Buttes Resources Co.

**Syria**
Souedie—Syrian Petroleum Co.

**Trinidad**
Galeota Mix (Trinidad Blend)—Amoco

**Tunisia**
Ashtart—Elf Aquitaine
El Borma—AGIP

**United Kingdom**
Argyll—Hamilton Bros.
Auk—Shell/Esso
Beatrice—Britoil
Beryl—Mobil
Brae—Marathon
Brent—Shell/Esso
Brent Blend
Buchan—BP
Cormorant, North—Shell/Esso
Cormorant, South (Cormorant "A")—Shell/Esso
Dunlin—Shell/Esso
Flotta—Occidental/Texaco
Forties—BP
Fulmar—Shell/Esso
Magnus—BP
Maureen—Phillips Petroleum
Montrose—Amoco
Murchison—Conoco
Ninian Blend—Chevron/Union/BP
Statfjord—Conoco
Tartan—Texaco
Thistle—Britoil

**U.S.**
Alaska North Slope (ANS, Sadlerochit)—Sohio/Exxon/ARCO
Kuparuk—ARCO
West Sak—ARCO

**U.S.S.R.**
Soviet Export Blend—V/O Sojuznefteexport

**Venezuela**
BCF 24—Affiliate of Petroleos de Venezuela
Bachaquero—Affiliate of Petroleos de Venezuela
Boscan—Affiliate of Petroleos de Venezuela
Ceuta—Affiliate of Petroleos de Venezuela
Lagomedio—Affiliate of Petroleos de Venezuela
La Rosa—Affiliate of Petroleos de Venezuela
Leona—Affiliate of Petroleos de Venezuela
Merey—Affiliate of Petroleos de Venezuela
Tia Juana Light—Affiliate of Petroleos de Venezuela
Tia Juana Pesado—Affiliate of Petroleos de Venezuela

**Zaire**
Zaire—Zaire Gulf Oil Co.

*Names in parentheses are former or secondary names of crudes. Companies listed are primary operators or sales contacts.

GUIDE TO EXPORT CRUDES FOR THE 80's

# Colombia's Caño Limón crude ready for export

**Richard Corbett**
Refining Editor

The completion of the Caño Limón pipeline and offshore loading facilities last month put Colombia's new Caño Limón crude into the world crude oil trade. Operators of the field, Empresa Colombia de Petroleos (Ecopetrol), Occidental de Colombia Inc., and Shell de Colombia Inc., expect an initial tanker loading capability of 90,000 b/d with total capacity reaching 250,000 b/d in by July.

The crude oil will be loaded from a tanker-loading facility and a floating storage unit located offshore in the Carribean Sea at the Covenas marine terminal. The loading facility will have two CALM buoys each capable of handling 40,000 bbl/hr, and will be able to handle two shuttle tankers at once. Information regarding assays in this series, is in OGJ, Apr. 11, 1983.

## Caño Limón, Colombia

### *Covenas terminal to two CALM in Carribean Sea*

**Crude**
Gravity, °API: 30.8
Sulfur, wt %: 0.47
Salt, lb/1,000 bbl: 2.0
Pour pt.; °F.: 60
Vis., cSt @ 100° F.: 12.54
Vis., cSt @ 120° F.: 8.19
Neut. No., mg KOH/g: 0.27
Rvp, psi: 0.7
$H_2S$, scf/100 gal crude: 0.02

**Light naphtha**
Range, °F.: IBP −220
Gravity, °API: 72.6
Yield, vol %: 3.94
Sulfur, wt %: 0.02
Mercaptan sulfur, vol %: 0.0002
Paraffins, vol %: 76.2
Naphthenes, vol %: 23.2
Aromatics, vol %: 0.6
Rvp, psi: 8.4

**Naphtha**
Range, °F.: 220-300
Gravity, °API: 59.3
Yield, vol %: 6.83
Sulfur, wt %: 0.01
Paraffins, vol %: 55.9
Naphthenes, vol %: 42.5
Aromatics, vol %: 1.6

**Heavy naphtha**
Range, °F.: 300-360
Gravity, °API: 51.9
Yield, vol %: 5.64
Sulfur, wt %: 0.01
Paraffins, vol %: 52.7
Naphthenes, vol %: 43.9
Aromatics, vol %: 3.4

**Kerosine**
Range, °F.: 360-500
Gravity, °API: 42.2
Yield, vol %: 21.09
Sulfur, wt %: 0.08
Mercaptan sulfur, vol %: 0.0004
Doctor: sweet
Smoke pt., mm: 22
Aniline pt., °F.: 163
Diesel index: 68.8
Pour pt., °F.: −60
W&N factor: 11.9
Vis., cSt @ 100° F.: 1.95

**Light gas oil**
Range, °F.: 500-700
Gravity, °API: 33.0
Yield, vol %: 22.04
Aniline pt., °F.: 182
Diesel index: 60.1
Pour pt., °F.: 30
Carbon residue, Rams., wt %: 0.08
Sulfur, wt %: 0.33
W&N factor: 11.9
Vis. cSt @ 100° F.: 7.16
Vis. cSt @ 210° F.: 2.04
Viscosity index: 82.4
Refractive index @ 67° C.: 1.4604
Basic nitrogen, wt %: 0.0081
Bromine No.: 5.7
V/Fe/Ni, ppm: 0.05/0.05/0.05

**Atmospheric residuum**
Range, °F.: 700+
Gravity, °API: 15.1
Yield, vol %: 39.89
Pour pt., °F.: 100
Carbon residue, Rams, wt %: 9.91
Sulfur, wt %: 0.84
W&N factor: 11.7
Vis., cSt @ 100° F.: 3,700.0
Vis., cSt @ 210° F.: 61.03
Viscosity index: 22.5

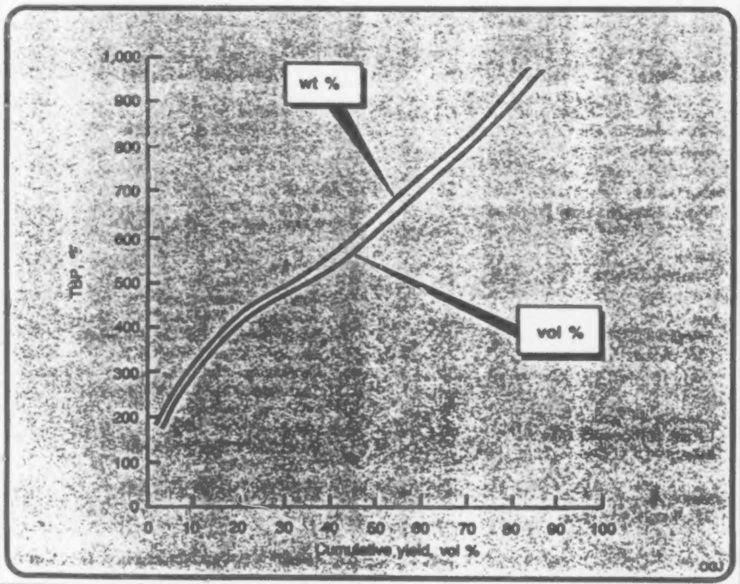
**Vacuum gas oil**
Range, °F.: 700-800
Gravity, °API: 26.5
Yield, vol %: 3.16
Aniline pt., °F.: 200
Diesel index: 53.0
Pour pt., °F.: 90
Carbon residue, Rams., wt %: 0.32
Sulfur, wt %: 0.52
W&N factor: 12.0
Vis., cSt @ 100° F.: 34.00
Vis., cSt @ 210° F.: 4.83
Viscosity index: 49.6
Refractive index @ 67° C.: 1.4766
Basic nitrogen, wt %: 0.0225
Bromine No.: 6.8
V/Fe/Ni, ppm: 0.05/0.20/1.40

**Vacuum gas oil**
Range, °F.: 800-1,000
Gravity, °API: 24.1
Yield, vol %: 15.01
Aniline pt., °F.: 210
Diesel index: 50.6
Pour pt., °F.: 105
Carbon residue, Rams, wt %: 0.44
Sulfur, wt %: 0.54
W&N factor: 12.0
Vis., cSt @ 100° F.: 65.00
Vis., cSt @ 210° F.: 6.72
Viscosity index: 43.1
Refractive index @ 67° C.: 1.4837
Basic nitrogen, wt %: 0.0289
Bromine No.: 10.0
V/Fe/Ni, ppm: 0.05/0.05/0.70

**Vacuum residuum**
Range, °F.: 1,000 +
Gravity, °API: 8.1
Yield, vol %: 21.74
Carbon residue, Rams., wt %: 19.26
Sulfur, wt %: 1.10
V/Fe/Ni, ppm: 41.5/12.00/95.00

Fig. 1

Cano Limon crude oil distillation



# Two high-quality onshore crude oils, Sharjah

**Richard A. Corbett**
Refining Editor

Two northern U.A.E. condensates are actually considered high-quality crude oils. Both have respectable yields in the gas-oil range. Sharjah Condensate is produced from the Saaja gas/condensate field in Sharjah, U.A.E. Initial production, which began in mid-1982, is now 60,000 b/d.

The condensate is transported to the Hamriyah terminal through a 20-mile, 12-in. pipeline. From the terminal, the condensate travels through a 30-in. pipeline to a single point mooring (SPM) buoy in the Persion Gulf. The SPM can handle 250,000 dwt tankers.

Margham Light is produced in Dubai. Production from the Margham gas/condensate field, discovered in 1982, is presently 25,000 b/d. The condensate moves by pipeline to the new Port of Jebal Ali outside Dubai which can handle very large crude tankers. Information regarding these assays, and previous assays in the series, is in OGJ, Apr. 11, 1983.

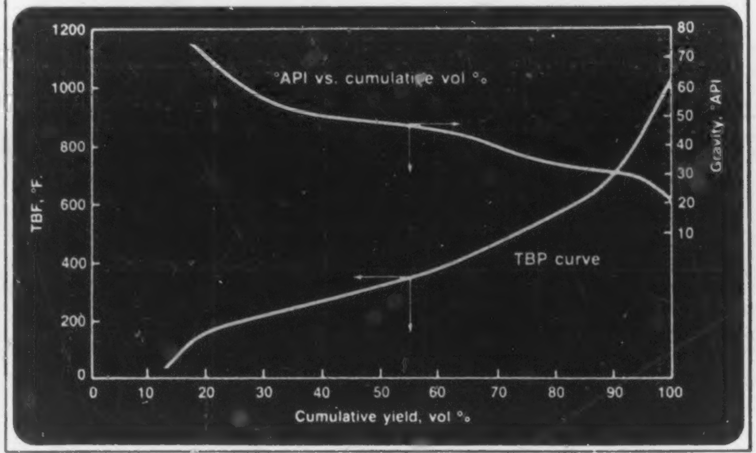
## Sharjah Condensate, Sharjah, U.A.E.

### *Hamriyah terminal to SPM in Persian Gulf*

**Crude**
Gravity, °API: 49.7
Sp gr, 60° F.: 0.7809
Sulfur, wt %: 0.10
Rvp, psi: 10.2
Pour pt., °F.: −25
Nuet no., mg KOH/g: 0.01
Rams. car., wt %: 0.1
Kin. vis., cst @ 68° F.: 1.44
  @ 100° F.: 0.96
V/Ni/Fe,ppm:0/0/0

**Gasoline**
Range, °F.: $C_5$ - 200
Yield, vol %: 21.9
Gravity, °API: 72.8
Sulfur, wt %: 0.024
Rvp, psi: 10.7
Charac. factor 12.16
P/N/A, vol %: 78.4/14.4/7.2
RONC: 73.7
MONC: 72.3

**Sharjah condensate**



**Naphtha**
Range, °F.: 200-320
Yield, vol %: 22.3
Gravity, °API: 50.9
Sulfur, wt %: 0.008
Rvp, psi: 1.2
Charac. factor: 11.51
P/N/A, vol %: 55.9/21.5/22.6
RONC: 61.6
MONC: 60.0

**Heavy naphtha**
Range, °F.: 320-400
Yield, vol %: 11.6
Gravity, °API: 46.8
Sulfur, wt %: 0.006
Charac. factor: 11.76
Aromatics, vol %: 27.2
Aniline pt., °F.: 124.9
Diesel index: 58.4
Cetane index: 36.9
Freeze pt., °F.: −74
Smoke pt., mm: 22

**Kerosine**
Range, °F.: 320-520
Yield, vol %: 25.8
Gravity, °API: 42.2
Sulfur, wt %: 0.032
Rvp, psi: 11.69
Aromatics, vol %: 33.4
Aniline pt., °F.: 137.5
Diesel index: 58.0
Cetane index: 40.3
Freeze pt., °F.: −53
Cloud pt., °F.: −64
Pour pt., °F.: −67
Smoke pt., mm: 20
Nuet. no., mg KOH/g: 0.03
Vis., SUS @ 68° F.: 31.8

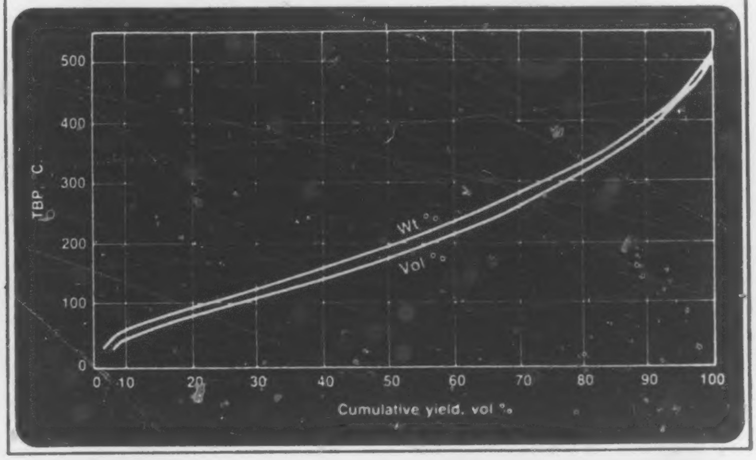
**Diesel**
Range, °F.: 520-650
Yield, vol %: 10.9
Gravity, °API: 33.8
Sulfur, wt %: 0.266
Charac. factor: 11.75
Aniline pt., °F.: 156.4
Diesel index: 56.2
Cetane index: 49.5
Cloud pt., °F.: 24
Pour pt., °F.: 21
Nitrogen, wt %: 0.006
Nuet. no., mg KOH/g: 0.05
Vis., SUS @ 68° F.: 44.8
  @ 122° F.: 36.3

**Gas oil**
Range, °F.: 650-850
Yield, vol %: 9.1
Gravity, °API: 29.7
Sulfur, wt %: 0.392
Charac. factor: 11.95
Pour pt., °F.: 80
Nitrogen, wt %: 0.030
Nuet. no., mg KOH/g: 0.09
Rams. Car., wt %: 0.01
Vis., SUS @ 122° F.: 58.9
  @ 210° F.: 38.0

**Residuum**
Range, °F.: 650+
Yield, vol %: 13.3
Gravity, °API: 27.8
Sulfur, wt %: 0.413
Pour pt., °F.: 89
Nitrogen, wt %: 0.046
Rams. car., wt %: 0.52
Vis., SUS @ 122° F.: 75.2
  @ 210° F.: 42.8
V/Fe ppm: 1/1

**Residuum**
Range, °F.: 850+
Yield, vol %: 4.2
Gravity, °API: 23.8
Sulfur, wt %: 0.457
Pour pt., °F.: 122

# Condensate and Margham Light, are assayed



Margham light

Nitrogen, wt %: 0.079
Rams. car., wt %: 1.57
Vis., SUS @ 122° F.: 281
@ 210° F.: 70.9
V/Fe, ppm: 2/2

## Margham Light, Dubai, U.A.E.

### *Port of Jebal Ali*

**Crude**
Gravity, °API: 50.33
Vis. cSt @ 20° C.: 1.49
Pour pt., °C.: −8
Rvp psi: 9.8
Salt, mg/l: 4
Water, wt %: 0.008
Water, vol %: < 0.01
$H_2S$, ppm: <5
Neut. no., mg KOH/g: <0.01
Sediment, wt %: <0.01
Sulfur, wt %: 0.04
Wax content, wt %: 4.04
Con. carbon, wt %: 0.03
Ash, wt %: <0.01
Asphaltenes, wt %: 0.05
Calorific value, BTU/lb: 20207
V/Ni/Na, ppm: <0.1/<0.1/0.4

**Light naptha**
Range, °C.: IBP-75
Yield, vol %: 12.88
Gravity, °API: 81.30
Sulfur, wt %: 0.02
Mercaptan sulfur, ppm: <5
Paraffins, wt %: 81.6
Naphthenes, wt %: 10.9
Aromatics, wt %: 7.5
Olefins, vol.%: 0.6

**Naphtha**
Range, °C.: 75-165
Yield, vol %: 29.64
Gravity, °API: 53.15
Sulfur, wt %: 0.01
Mercaptan sulfur, ppm: <5
Paraffins, wt %: 45.1
Naphthenes, wt %: 25.0
Aromatics, wt %: 29.9
Olefins, vol %: 1.0

**Kerosine**
Range, °C.: 165-235
Yield, vol %: 16.89
Gravity, °API: 44.52
Sulfur, wt %: 0.02
Smoke pt., mm: 22
Freeze pt °C.: −53
Aromatics, vol %: 20.4
Flash pt °C.: 61
Copper strip corrosion: 1a
Existent gum, mg/100 ml: 1
Neut. no., mg KOH/g: <0.01

**Diesel**
Range, °C.: 235-300
Yield, vol %: 13.34
Gravity, °API: 37.22
Sulfur, wt %: 0.02
Cetane index: 51
Pour pt. °C.: −26
Cloud pt. °C.: −23
Cold filter plug pt. °C.: −25
Kin. cSt @ 37.8° C.: 2.79
Kin. cSt @ 50° C.: 2.22
Neut. no., mg KOH/g: <0.01
Con. carbon, 10% bott., wt %: 0.04
Flash pt., °C.: 113
Copper strip corrosion: 1a
Aniline pt. °C.: 70.6
Nitrogen, wt %: <0.01

**Diesel**
Range, °C.: 300-350
Yield, vol %: 7.25
Gravity, °API: 36.66
Sulfur, wt %: 0.27
Cetane index: 58
Pour pt. °C.: 1
Cloud pt. °C.: 3
Cold filter plug pt. °C.: 1
Kin. cSt @ 37.8° C.: 6.00
Kin. cSt @ 50° C.: 4.40
Neut. no., mg KOH/g: <0.01
Con. carbon, 10% bott., wt %: 0.73
Flash pt., °C.: 159
Copper strip corrosion: 1a
Nitrogen, wt %: <0.01

**Gas oil***
Range, °C.: 350-370
Yield, vol %: 2.63
Gravity, °API: 34.18
Sulfur, wt %: 0.25
Cloud pt., °C.: 26
*Insufficient sample for complete analysis of this fraction.

**Heavy gas oil**
Range, °C.: 350-514.3
Yield, vol %: 13.78
Gravity, °API: 32.04
Sulfur,wt %: 0.18
Kin. cSt @ 37.8° C.: 22.5
@ 50° C.: 14.6
@ 82.2° C.: 6.05
@ 100° C.: 4.26
Pour pt., °C.: 36
Asphaltenes, wt %: <0.05
Con. carbon, wt %: <0.01
V/Ni, mg/kg: <0.1/0.2
Neut. no., mg KOH/g: 0.05
UOP K: 12.40
Nitrogen, wt %: <0.01
Aniline pt., °C.: 103.1
Wax, wt %: 17.2
Ash, wt %: <0.01
Sediment, wt %: <0.01

**Residue**
Range, °C.: 350+
Yield, vol %: 13.98
Gravity, °API: 31.73
Sulfur, wt %: 0.17
Kin. cSt @ 37.8° C.: 25.2
@ 50° C.: 14.9
@ 82.2° C.: 6.51
@ 100° C.: 4.58
Pour pt., °C.: 32
Asphaltenes, wt %: <0.05
Con. carbon, wt %: 0.04
V/Ni, mg/kg: <0.1/0.9
Neut. no., mg KOH/g: 0.15
Nitrogen, wt %: 0.02
Aniline pt., °C.: 102.4
Wax, wt %: 20.3
Ash, wt %: 0.01
Sediment, wt %: <0.01

# Australian regulatory changes open crudes to export

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**Richard A. Corbett**
Refining/Petrochemical Editor

Since the price collapse of 1986, the Australian Government has been deregulating its domestic crude oils, which since the late 1960s, have been allocated solely to Australian refiners at set prices, and where no crude oil was exported.

This arrangement is now being dismantled, and has allowed export since 1983, with modest free-market sales since 1985.

Much of the exported crude is currently from older, established fields, but with a number of new fields that have come into production recently, some of the newer streams are beginning to find their way to many distant parts of the refining world.

There are five important Australian crude oils either now being, or likely to be, exported: Barrow Island and Gippsland crudes, which are produced from fields discovered in the 1960s; and Jabiru, Jackson blend, and Northwest Shelf condensate, all coming to production during the last 5 years.

**Gippsland.** Gippsland crude oil, also known as Bass Strait, is produced from the Gippsland basin, offshore Victoria in the eastern Bass Strait. The operator, Esso Exploration Australia, has a 50% interest in the basin, with the other 50% owned by BHP Petroleum Pty. Ltd. Production rates for crude and condensate from the basin were estimated at about 455,000 b/d in late 1986.

Gippsland crude is a light, sweet premium crude capable of producing very high yields of transport fuels with minimal refinery treatment (see assay) because atmospheric distillates to about 75 vol % of crude are obtainable. The intermediate, paraffinic-base crude contains moderate wax, but has a low viscosity.

The light straight run naphtha contains a high proportion of isoparaffins, making it a good gasoline base blendstock. The medium and heavy naphthas are good isomerization and reforming feeds because of high naphthenes and aromatics content. Sulfur content of the gas oils is less than 0.25 wt %, making it suitable for low-sulfur fuel oil, but better suited for catalytic cracking because of its low metals content.

Loading jetties for the crude are located at Long Island Point and Crib Point in Westernpoint Bay, about 100 km south of Melbourne in Victoria.

Each jetty can handle tankers up to 100,000 dwt, with pumping rates of 55,000 bbl/hr at Long Island, and 45,000 bbl/hr at Crib Point.

**Barrow Island.** The Barrow Island oil field, found in 1964, was the first oil discovery in Australia. The crude is named for the island on which it is produced, located off the northwest coast of Western Australia.

The field is operated by West Australian Petroleum Pty. Ltd. (Wapet). Wapet is a consortium of subsidiaries of Chevron Corp., Texaco Inc., and Royal Dutch Shell, each with a two-sevenths interest, and Ampol Exploration of Australia with a one-seventh interest

Barrow Island crude is a sweet, moderately light crude with good yields of naphthas and middle distillates. Light gas oil and heavier cuts are low in sulfur and metals contents, making them suitable for low-sulfur fuel oil and catalytic cracking.

Barrow Island crude is loaded from a single buoy mooring (SBM) off Barrow Island and shipped to refining centers in Australia. Despite the fact that production has been declining from this mature field to about 15,000 b/d presently, with the changes in Australian regulations, some of the crude may still find its way to refineries around the world.

**Jabiru.** The Jabiru oil field, named after a rare tropical northern Australian stork, is located in the Timor Sea frontier about 300 km off the Kimberly coast of Australia's Northern Territory, and about 680 km west of Darwin. Discovered in 1983, present production is about 13,500 b/d, but that is expected to be increased in the near future.

BHP Petroleum Pty. Ltd. is the operator of the field, holding a 50% interest, with the other participants: Ampol Exploration, 6.25%; Brenda Mines, 1.1%; Esso Exploration and Production, Australia, 18.75%; Norpac Securities, 1.1%; Norcen International 12.5%; and Peko Oil, 10.3%. BHP is also developing the nearby Chalis field.

Jabiru crude is somewhat less waxy than Gippsland crude, but has similar properties. It is an intermediate/paraffinic base classed crude with low sulfur and metals contents. Substantial yields of middle distillate make it a good crude for refiners that emphasize product slates in the middle distillate range. The low sulfur and metals contents of the resid make it suitable for direct feeding to catalytic crackers.

Crude is loaded through a floating production system (FPS) that contains processing equipment to stabilize the crude oil in Jabiru field (see Fig. l and cover photo). The FPS is the converted 140,000-dwt tanker Jabiru Venture. Total storage capacity is about 1 million bbl (OGJ, Sept. 7, 1987, pp. 53-58).

The loading system can handle vessels in the range of 25,000-150,000 dwt, and is able to deliver parcel sizes up to 770,000 bbl at flow rates to 20,000 bbl/hr.

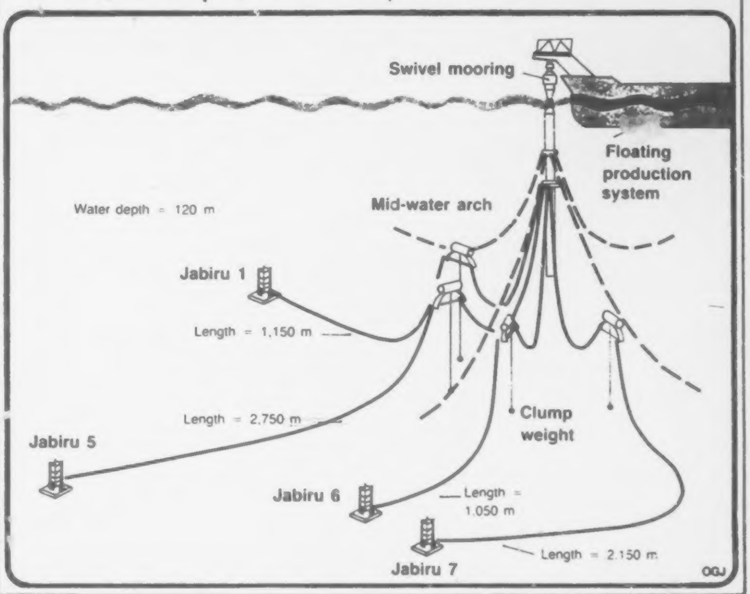
**Northwest Shelf condensate.** The Northwest Shelf project, encompassing three major gas fields off the Pilbara coast of Western Australia and a world scale LNG plant now under construction, produces the high-quality Northwest Shelf condensate. The project, about 1,200 km north of Perth, produced about 8,000 b/d of condensate in 1986, and was expected to double that amount in early 1987.

Woodside Petroleum is the operator in a joint venture with BP Development Australia, California Asiatic Oil Co., Shell Development Australia, and BHP Petroleum Pty. Ltd.

The high API gravity condensate provides good yields (65-66 vol %) of naphthas and about 30 vol % middle distillates. The naphthas are suitable for reforming into gasoline blendstock or aromatic petrochemical feedstocks. Total sulfur content is very low at 70 ppm.

Fig. 1

BHP's Jabiru production system



The first assay, conducted in November 1986, was completed on a sample with an Rvp of 6 psi. In January 1987, gas processing plant changes produced a condensate with an Rvp of 10 psi. Properties for the whole condensate are given for both the 6 and 10 psi Rvp streams (values in parentheses are for those properties that changed for the 10 psi Rvp stream; see assay). There were no significant differences observed in the density and other relevant properties in any fraction of the 10 psi Rvp condensate compared to the 6 psi Rvp condensate; therefore, 10 psi Rvp data are not included in the assay data for the fractions.

Northwest Shelf condensate is loaded from a dolphin berth in Withnell Bay. The berth can accomodate vessels from 19,500-130,000 dwt at loading rates to 18,000 bbl/hr.

**Jackson blend.** Jackson blend crude is supplied from the Cooper basin in southwestern Queensland. It is a blend of about 12 crudes from several oil fields producing in the area. Two of the participants in the field are Santos Ltd. and BHP Petroleum Pty. Ltd.

The crude is shipped via a 12-in., 495-mile pipeline completed in 1985, to Moonie in Queensland where it connects to an earlier-constructed pipeline to Brisbane. Initial flow was slated at 16,000 b/d, but the design of the line will allow up to 55,000 b/d. The line connects to the Ampol refinery at Lytton, near Brisbane.

Crude is loaded across the refinery for export. Although none of the crude is being exported at present, it is highly possible that it will in the near future.

Crude oil assays with more information on the Australian crudes follow.

### Key to the assays...

Each assay is headed, in the following order, by the official name of the crude, the former or secondary name in parenthesis, and location and type loading facilities. Loading systems that frequently crop up are abbreviated. Those used are CBM (conventional buoy mooring), SPM (single point mooring), SBM (single buoy mooring), CALM (catenary anchor leg mooring), and SALM (single anchor leg mooring).

## Gippsland (Bass Strait)

*Jetties at Long Island Point and Crib Point*

**Crude**

Gravity, °API: 45.4
Density @ 15° C.: 0.7993
Total sulfur, wt %: 0.10
Salt, lb/1,000 bbl: 0.5

Rvp, psi: 5.1
Total N, wt %: 0.15
Pour pt, °C.: 15
Wax, wt %: 8.9
Vis. @ 21.1° C., cSt: 2.93
Vis. @ 37.8° C., cSt: 2.03
Acid no., mg KOH/g: 0.11

### Naphtha

Range, °C.: 20-190
Yield, vol %: 39.3
Gravity, °API: 61.6
Density @ 15° C., kg/l.: 0.7327
Sulfur, wt %: 0.03
P/N/A, vol %: 59.1/32.5/8.4

### Kerosine

Range, °C.: 190-230
Yield, vol %: 7.1
Gravity, °API: 44.9
Density @ 15° C., kg/l.: 0.8432
Sulfur, wt %: 0.06
Aromatics, vol %: 14.7
Pour pt, °C.: −43
Smoke pt, mm: 22
Aniline pt, °C. 62.5
Cetane index: 44.7
Vis. @ 100° C., cSt: 1.44

### Gas oil

Range, °C.: 230-340
Yield, vol %: 23.1
Gravity, °API: 36.2
Density @ 15° C., kg/l.: 0.8432
Sulfur, wt %: 0.08
Pour pt, °C.: −6
Cloud pt, °C.: −4
Cetane index: 51.7

### Heavy gas oil

Range, °C.: 340-565
Yield, vol %: 27.4
Gravity, °API: 31.5
Density @ 15° C., kg/l.: 0.8678
Sulfur, wt %: 0.16
Wax, wt %: 35.6
Pour pt, °C.: 51
Aniline pt, °C.: 100.7
Rams. carbon, wt %: 0.3
Ni/V, ppm: 0.1/0.2
Vis. @ 100° C., cSt 4.06

### Residue

Range, °C.: 370+, 690+
Yield, vol %: 23.6
Gravity, °API: 30.4
Density @ 15° C., kg/l.: 0.8733
Sulfur, wt %: 0.22
Pour pt, °C.: 45
Ni/V, ppm: 0.3/0.6
Asphaltenes, wt %: 0.42

## Barrow Island

*SBM off Barrow Island*

### Crude

Gravity, °API: 36.8
Sulfur, wt %: 0.05
Kin. vis. @ 10° C., cSt: 3.40
Kin. vis. @ 100° C., cSt: 1.80
Pour pt, °C.: −30
Total acid no., mg KOH/g: 0.21

### Gasoline

Range, °C.: $C_5$-65
Yield, vol %: 3.4
Density @ 15° C., kg/l.: 0.646
Sulfur, ppm: <50
RON clear: 78
P/N/A, vol %: 91/9/0

### Light straight run

Range, °C.: 65-100
Yield, vol %: 7.7
Density @ 15° C., kg/l.: 0.728
Sulfur, ppm: <50
Ron clear: 70
P/N/A, vol %: 40/58/2

### Naphtha

Range, °C.: 100-150
Yield, vol %: 14.4
Density @ 15° C., kg/l.: 0.759
Sulfur, ppm: <50
P/N/A, vol %: 46/47/7

### Heavy naphtha

Range, °C.: 150-200
Yield, vol %: 15.5
Density @ 15° C., kg/l.: 0.803
Sulfur, wt %: 0.01
Aromatics, vol %: 12
Smoke pt, mm: 27
Freeze pt, °C.: <−60

### Kerosine

Range, °C.: 200-250
Yield, vol %: 16.9
Density @ 15° C., kg/l.: 0.853
Kin. vis., @ 40° C., cSt: 1.67
Sulfur, wt %: 0.015
Cloud pt, °C.: −30
Aromatics, vol %: <20
Smoke pt, mm: 19
Freeze pt, °C.: <−60

### Diesel

Range, °C.: 250-300
Yield, vol %: 14.6
Density @ 15° C., kg/l.: 0.886
Kin. vis. @48° C., cSt: 3.4
Sulfur, wt %: 0.02
Pour pt, °C.: <−30
Cloud pt, °C.: <−30
Cetane index: 36.5

### Gas oil

Range, °C.: 300-350
Yield, vol %: 9.7
Density @ 15° C., kg/l.: 0.906
Kin. vis. @ 40° C., cSt: 8.11
Sulfur, wt %: 0.05
Pour pt, °C.: −30
Cloud Pt, °C.: −26
Cetane index: 41

### Heavy gas oil

Range, °C.: 350-370
Yield, vol %: 2.7
Density @ 15° C., kg/l.: 0.922
Density @ 70° C., kg/l.: 0.884
Kin. vis. @ 40° C., cSt: 18.2
Sulfur, wt %: 0.09
Pour pt., °C.: −9
Cloud pt., °C.: −8

### Residue

Range, °C.: 370+
Yield, vol %: 14.5
Density @ 15° C., kg/l.: 0.953
Density @ 70° C., kg/l.: 0.917
Kin. vis. @ 60° C., cSt: 63.9
Kin. vis. @ 100° C., cSt: 15.6
Sulfur, wt %: 0.16
Wax content, wt %: 3.5
Pour pt, °C.: 12
Acid no., mg KOH/g: 0.16
Asphaltenes, wt %: 0.2
Con. carbon, wt %: 3.2
V/Ni, ppm: 1/6

## Jabiru

*Floating production system in offshore producing area*

### Crude

Gravity, °API: 42.3
Total sulfur, wt %: 0.04
Salt, ppm: 38.6
Total N, wt %: 0.05
Rvp, psi: 4.5
UOP K: 11.9
Total acid no., mg KOH/g: 0.02
Asphaltenes, wt %: <0.05
Ni/V/Na, ppm: 3/0.1/11

### Light naphtha

Range, °C.: 20-70
Yield, vol %: 3.9
Gravity, °API: 84.5
Density @ 15° C., kg/l.: 0.6551
Sulfur, wt %: 0.01
P/N/A, vol %: 87.7/11.9/0.4

### Heavy naphtha

Range, °C.: 70-190
Yield, vol %: 23.0
Gravity, °API: 54.8
Density @ 15° C., kg/l.: 0.7593
Sulfur, wt %: 0.01
P/N/A, vol %: 49/38.2/12.8

### Kerosine

Range, °C.: 150-230
Yield, vol %: 16.8
Gravity, °API: 47.3
Density @ 1° C., kg/l.: 0.7911
Sulfur, wt %: <0.01
Aromatics, vol %: 16.3

Freeze pt, °C.: −54
Smoke pt, mm: 25
Aniline pt, °C.: 58.4
Vis. @ 40° C., cSt: 1.13

**Kerosine**
Range, °C.: 190-230
Yield, vol %: 9.2
Gravity, °API: 44.5
Density @ 15° C., kg/l.: 0.8036
Sulfur, wt %: <0.001
Aromatics, vol %: 14.8
Freeze pt, °C.: −43
Smoke pt, mm: 25
Aniline pt, °C.: 63.0
Vis. @ 40° C., cSt: 1.36

**Gas oil**
Range, °C.: 230-360
Yield, vol %: 37.9
Gravity, °API: 37.5
Density, @ 15° C., kg/l.: 0.8370
Sulfur, wt %: 0.02
Wax, wt %: 0.2
Pour pt, °C.: −3
Cloud pt, °C.: −2
Aniline pt, °C.: 75.0
Cetane index: 54.0
Vis. @ 100° C., cSt: 3.29

**Heavy gas oil**
Range, °C.: 360-540
Yield, vol %: 22.5
Gravity, °API: 30.8
Density @ 15° C., kg/l.: 0.8713
Sulfur, wt %: 0.10
Wax, wt %: 28.3
Pour pt., °C.: 39
Aniline pt, °C.: 97.8
Rams. carbon, wt %: 0.12
Ni/V ppm: 1.0/0.1
Asphaltenes, wt %: 0.08
Vis. @ 100° C., cSt: 4.05

**Residue**
Range, °C.: 360+
Yield, vol %: 24.1
Gravity, °API: 29.4
Density @ 15° C., kg/l.: 0.8791
Sulfur, wt %: 0.12
Wax, wt %: 28.1
Pour pt, °C.: 39
Rams. carbon, wt %: 0.24
Ni/V, ppm: 2.2/0.2
Asphaltenes, wt %: 0.08
Vis. @ 100° C., cSt: 4.77

**Residue**
Range, °C.: 540+
Yield, vol %: 1.6
Gravity, °API: 10.5
Density @ 15° C., kg/l.: 0.9962
Sulfur, wt %: 0.32
Pour pt, °C: 51
Rams. carbon, wt %: 12.5
Ni/V, ppm: 29/2.7
Asphaltenes, wt %: 1.9
Vis. @ 100° C., cSt: 239.5

## Northwest Shelf condensate

*Dolphin berth in Withnell Bay*

**Whole condensate, 6 Rvp (10 Rvp)**
Gravity, °API: 53.1 (55.8)
Density, @ 15° C., kg/l.: 0.7661 (0.7551)
Total sulfur, ppm: 102
Salt, mg/l.: 12.8
Rvp, psi: 6.1 (10.5)
Total N, wt %: 0.005
Pour pt, °C.: −36
Wax, wt %: <0.1
Vis. @ 20° C., cSt: 0.99 (0.90)
Vis. @ 40° C., cSt: 0.80 (0.73)
RON clear: 54.0 (58.6)
UOP K: 11.8 (11.6)
Total acid no., mg KoH/g: 0.02
Aromatics, vol %: 10.7 (10.8)
Ni/V, ppm: 0.2/<0.1
Na/Cu/Fe, ppm: 0.5/1.0/1.1

**Gasoline**
Range, °C.: $C_5-70$
Yield, vol %: 17.1
Gravity, °API: 85.9
Density @ 15° C., kg/l.: 0.6508
Sulfur, wt %: 0.004
n-paraffins, vol %: 46.0
i-paraffins, vol %: 43.2
Naphthenes, vol %: 9.5
Aromatics, vol %: 1.3

**Naphtha**
Range, °C.: 70-190
Yield, vol %: 50.3
Gravity, °API: 53.9
Density @ 15° C., kg/l.: 0.7630
Sulfur, wt %: 0.004
n-paraffins, vol %: 21.2
i-paraffins, vol %: 20.4
Aromatics, vol %: 16.8

**Kerosine**
Range, °C.: 150-230
Yield, vol %: 18.2
Gravity, °API: 44.2
Density @ 15° C., kg/l.: 0.8049
Sulfur, wt %: 0.02
Aromatics, vol %: 22.3
Freeze pt, °C.: −60
Smoke pt, mm: 21
Aniline pt, °C.: 48.6
Vis. @ 40° C., cSt: 1.06

**Gas oil**
Range, °C: 190-230
Yield, vol %: 8.4
Gravity, °API: 42.0
Density @ 15° C., kg/l.: 0.8152
Sulfur, wt %: 0.01
Aromatics, vol %: 19.7
Freeze pt, °C.: −47
Smoke pt, mm: 21
Aniline pt, °C.: 54.8
Vis. @ 40° C., cSt: 1.06

**Heavy gas oil**
Range, °C.: 230-360
Yield, vol %: 18.7
Gravity, °API: 33.5
Density @ 15° C., kg/l.: 0.8570
Sulfur, wt %: 0.03
Wax, wt %: <0.1
Pour pt, °C.: −12
Cloud pt, °C.: −13
Aniline pt, °C.: 63.8
Cetane index: 45.1
Vix. @ 40° C., cSt: 3.02
Vis. @ 100° C., cSt: 1.24

**Residue**
Range, °C.: 360+, 680+
Yield, vol %: 2.7
Gravity, °API: 29.3
Density @ 15° C., kg/l.: 0.8794
Sulfur, wt %: 33.0
Pour pt, °C.: 30
Rams. carbon, wt %: 0.31
Ni/V, ppm: 0.6/<0.1
Asphaltenes, wt %: 0.26
Vis. @ 100° C., cSt: 3.63

## Jackson blend

*Loaded across Ampol refinery at Lytton*

**Crude**
Gravity, °API: 41.9
Density @ 15° C., kg/l.: 0.8155
Sulfur, wt %: 0.03

**Light straight run**
Range, °C.: $C_5$-190
Yield, vol %: 16.5
RON clear: 25.9

**Gas oil**
Range, °C.: 190-230
Yield, vol %: 4.5
Aromatics, vol %: 7.0
Sulfur, wt %: 0.01

**Heavy gas oil**
Range, °C.: 230-320
Yield, vol %: 20.1
Sulfur, wt %: 0.02
Cloud pt, °C.: −1
Cetane index: 59.6

**Residue**
Range, °C.: 320+
Yield, vol %: 58.5
Con. carbon, wt %: 0.9
Ni/V, ppm: 0.4/0.1
Rams. carbn, wt %: 0.7

Pipes," SPE 4885, California Regional Meeting, San Francisco, Apr. 4-5, 1974.
3. Blauer, R.E., and Kohlhass, C.A., "Formation Fracturing with Foam," SPE 5003, 49th Annual Technical Conference, Houston, Oct. 6-9, 1974.
4. Blauer, R.E., and Holcomb, D.L., "Foam Fracturing - Application and History," Southwest Petroleum Short Course, Lubbock, April 1975.
5. Blauer, R.E., and Durborow, C.J., "Formation Fracturing with Stable Foam," U.S. Patent No. 3,937,283, Feb. 10, 1976.
6. Bullen, R.S., "Combination Foam/Fluid Fracturing," J. Con. Pet. Tech., July-September 1980, pp. 51-56.
7. Ainley, B.R., and Charles, J.G., "Fracturing Using Stabilized Foam Pad," SPE/DOE 10825, Symposium on Unconventional Gas Recovery, Pittsburgh, May 16-18, 1982.
8. Mitchell, B.J., "Viscosity of Foam," PhD dissertation, University of Oklahoma, 1969.
9. Strang, D.L., and Morton, J.L., "Foamed Sand Provides Improved Stimulation Results from Devonian Shale," SPE 2312, Eastern Regional Meeting, Champion , Pa., Nov. 9-11, 1983.
10. Mack, D.J., and Harrington, L.J., "$CO_2$ West Foam Design," Completion Engineering Newsletter, Western Petroleum Services, Fort Worth, October 1982, pp. 4-5.
11. Mack, David, West-Foam Design Manual, Western Petroleum Services, Fort Worth, January 1982, p. 12.
12. Mack, David, "$CO_2$ West-Foam," Completion Engineering Newsletter, Western Petroleum Services, Fort Worth, May 1984, p. 2.
13. Amyx, J.W., Bass, D.M., Jr., and Whiting, R.L., Petroleum Reservoir Engineering, McGraw-Hill Book Co., New York, 1960.
14. Hendricks, R.C., Baron, A.K., and Peller, I.C., "GASP: A Computer Code for Calculating the Thermodynamic and Transport Properties for Ten Fluids: Parahydrogen Helium, Neon Methane, Nitrogen, Carbon Monoxide, Oxygen, Fluorine, Argon and Carbon Dioxide," National Aeronautics and Space Administration, Lewis Research Center, Cleveland, February 1975.
15. Mach, David, "West-Foam/Energized System Flowback and Other Operational Considerations," Completion Engineering Newsletter, Western Petroleum Services, Ft. Worth, March 1983.
16. Mack, D., Mooney, M., and Terry, C., "Correct Procedures Improve Fracturing Treatments," Petroleum Engineer International, November 1983, pp. 64-74.
17. Reidenback, V.G., Harris, P.C., Lee, Y.N., and Lord, D.L., "Rheological Study of Foam Fracturing Fluids Using Nitrogen and Carbon Dioxide," SPE 12026, 58th Annual Technical Conference, San Francisco, Oct. 5-8, 1983.
18. Harris, P.C., and Reidenback, V.G., "High Temperature Rheological Study of Foam Fracturing Fluids," SPE 13177, 59th Annual Technical Conference, Houston, Sept. 16-19, 1984.
19. Couchman, D.D., and Phillips, A.M., "High Temperature Rheology of $CO_2$ Foam Fracturing Fluids," Laboratory Services Newsletter, Western Petroleum Services, Ft. Worth, March 1986.
20. Couchman, D.D., and Phillips, A.M., "High Temperature Rheology of $CO_2$ Foam Fracturing Fluids- Second Edition," Technical Services Newsletter, Western Petroleum Services, Ft. Worth, December, 1986.
21. Wendorf, C.L., and Ainsley, B.R., "Massive Hydraulic Fracturing of High Temperature Wells with Stable Foam Fracs," SPE 10257, 56th Annual Technical Conference, San Antonio, Oct. 5-7, 1981.
22. Goelitz, R., and Evertz, G.E., "Foam Fracturing in the Uinta Basin—A Field Study of the Dakota and Wasatch Formations," SPE 10883, Rocky Mountain Regional Meeting, Billings, Mont., May 19-21, 1982.
23. King, G.E., "Factors Effecting Dynamic Fluid Leakoff of Foam Fracturing Fluids," SPE 6817, 52nd Annual Technical Conference, Denver, Oct. 9-12, 1977.
24. Harris, P.C., "Dynamic Fluid Loss Characteristics of Foam Fracturing Fluids," SPE 11065, 57th Annual Technical Conference, New Orleans, Sept. 26-29, 1982.
25. Harris, P.C., "Dynamic Fluid Loss Characteristics of $CO_2$ Foam Fracturing Fluids," SPE 13180, 59th Annual Technical Conference, Houston, Sept. 16-19, 1984.
26. King, G.E., "Foam and Nitrified Fluid Treatments-Stimulation Techniques and More," SPE 14477.
27. Holcomb, D.L., "Foam for Fracturing and Acidizing Stimulation-Parts 1, 2, and 3," Drilling, January, February, and May 1982.
28. Mach, D.J., and Baumgartner, S.A., "Friction Pressure of Foamed Stimulation Fluids Evaluated With an On-Site Computer," SPE 15631, 61st Annual Technical Conference, New Orleans, Oct. 5-8, 1986.
29. Baumgartner, S.A., and Mack, D.J., "On-Site Monitoring of Foamed Stimulation Fluids," SPE 17531, SPE Rocky Mountain Regional Meeting, Casper, Wyo., May 11-13, 1988.
30. Hannah, R.R., Harrington, L.J., and Lance, L.C., "The Real Time Calculation of Accurate Bottomhole Fracturing Pressure from Surface Measurements Using Measured Pressures as a Base," SPE 12062, 58th Annual Technical Conference, San Francisco, Oct. 5-8, 1983.
31. Personal conversations with Ted Jacobson of Kaiser Francis, and Brian Dennis of Amoco Production.
32. Personal conversations with Fred Toney of Western Co.'s Woodward district.
33. For additional information regarding monitor conversion to Binary, contact Ronnie Lindley at network 423-7019.
34. "High Temperature Rheology of $CO_2/N_2$ Foam Fracturing Fluids," Technical Newsletter-Western Co., Ft. Worth, June 1, 1989.

# Detailed assays conducted on Vietnamese crude oils

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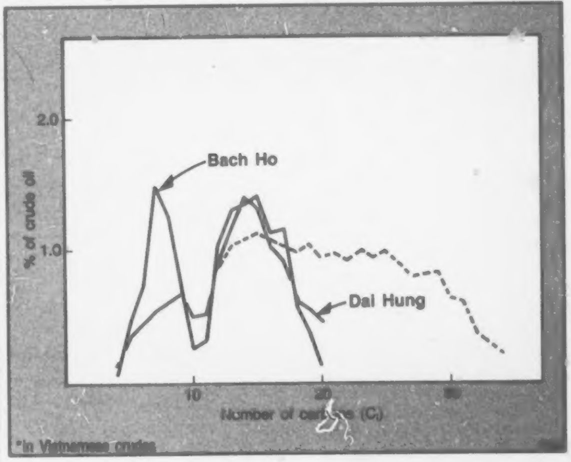
More oil property data, in the form of recent crude oil assays, have been made available for two Vietnamese crude oils, Bach Ho (White Tiger) and Dai Hung (Big Bear).

Crude oil data presented earlier (OGJ, Nov. 6, 1989, p. 39) gave limited properties of the crudes, which are from the Miocene formations.

Fig. 1

## Normal paraffin distribution*



*In Vietnamese crudes

Further analyses have been conducted on Bach Ho crude from the Oligocene formations. Production from Oligocene is far more representative of the oils produced from the Bach Ho field and marketed worldwide.

Currently, Bach Ho is the only producing field. Dai Hung is expected to be in production during the next few years.

Bach Ho is currently producing at the rate of 20,000 b/d. That figure is projected to grow to 100,000 b/d by 1992 and to 120,000 b/d by 1995.

Detailed assays of both crude oils are presented here.

**Naphtha properties**

A comparison of the naphtha cuts of both crude oils shows that the paraffin content, particularly of n-paraffin, of Dai Hung is much lower than that for Bach Ho (Table 1). But the aromatic content of Dai Hung is much higher than that for Bach Ho.

The difference between hydrocarbon group distributions of the naphtha cut compositions of Bach Ho and Dai Hung has a primary importance for gasoline-cut processing. Catalytic reforming of the gasoline cuts will be different for the two crudes.

The distribution of hydrocarbon groups of the Vietnamese crudes, particularly the distribution of n-paraffins, also has a large effect on transportation and processing of the these highly waxy crudes.

Fig. 1 shows the n-paraffin distribution of the two crude oils. It is clearly seen that for the naphtha cut, n-paraffin is higher for Dai Hung than for Bach Ho.

But for the diesel (gas oil) cut, the n-paraffin content ($C_{12}$-$C_{18}$) is similar for both crudes at about 9.5 wt %. With such a high n-paraffin content in the diesel cut, it is highly advisable to expect paraffin separation processing to decrease the pour point of the diesel and to supply the n-paraffins as raw material in petrochemical processing.

High-value petrochemical products could be: Sodium alkyl sulfonate, di-carboxilic acid, and cyclo pentadecanone.

Fig. 2

**Bach Ho n-paraffin distribution***

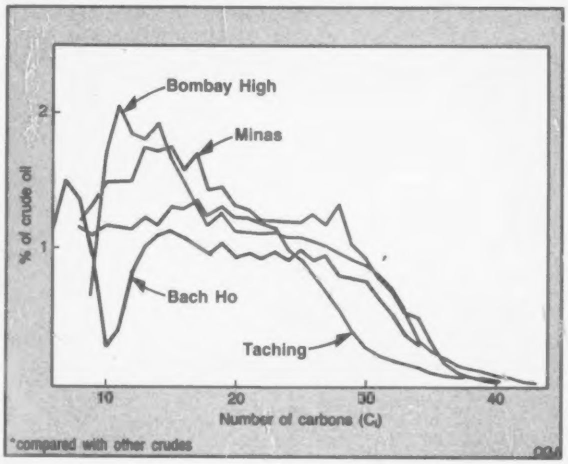


Fig. 2 compares the paraffin distribution of the Vietnamese crude oils to the distributions of Taching (China), Minas (Indonesia), and Bombay High (India). Complete assays of these crudes can be found in OGJ, Sept. 5, 1983, pp. 144 and 148, and OGJ, Nov. 21, 1983, p. 78.

Although Minas, Taching, and Bombay High are of high paraffin contents and have similar pour points, their n-paraffin distributions are completely different (Table 2). This greatly affects pour-point depressant utilization.

For example, the IFP pour point depressant TPE101 used at 500 ppm can lower the pour point of Bombay High to 12° C. from 30° C., according to IFP. But the same depressant used at 3,000 ppm in Bach Ho, reduces the pour point to only 27° C. from 33° C.

However, two pour point depressants, Chem Link P-7599 and P-7590, used at 500 ppm are able to reduce the pour point of Bach Ho to 21° C. from 33° C., according to experiments at Vietsovpetrol in April by Chem Link.

The differences in the effects of the IFP and Chem Link depressants when they are applied to Vietnamese crude oils show different mechanisms of action of chemicals on the n-paraffin distribution of the crudes.

In conclusion, the study of hydrocarbon group distribution, particularly the n-paraffin distribution in Vietnamese crude oils, has an important practical importance in the selection of the proper additives for transportation and production, but also for determination of processing orientation in view of obtaining high-value raw materials for petrochemicals production.

Table 1

*Paraffins and aromatics contents of naphtha cuts*

| n-paraffin content | Dai Hung | Bach Ho |
|---|---|---|
| Light naphtha cut ($C_5$ - 90° C.) | 21.4 % | 42.0 % |
| ($C_5$ - 149° C.) cut | 14.7 % | 34.9 % |
| Heavy naphtha cut ($C_5$ - 175° C.) | 13.5 % | 33.7 % |

| Aromatic content | Dai Hung | Bach Ho |
|---|---|---|
| $C_5$ - 90° C. | 19.7 % | 6.4 % |
| $C_5$ - 149° C. | 35.6 % | 8.2 % |
| 95 - 175° C. | [illegible]3.0 % | 9.8 % |

Table 2

*Waxy crude comparison*

| No | Crude | Wax, % | Pour point, °C. |
|---|---|---|---|
| 1 | Bach Ho | 26-27 | 33 |
| 2 | Taching | 16.1 | 36 |
| 3 | Minas | 18.7 | 36 |
| 4 | Bombay High | 11 | 30 |

# Bach Ho (White Tiger) Viet Nam

*Floating storage in South China Sea southeast of Ho Chi Minh City.*

**Crude**
Gravity, °API: 38.6
Sulfur, wt %: 0.03-0.05
Pour pt., °C.: 33
Vis, cSt @ 40° C.: 9.72
Vis, cSt @ 50° C.: 6.59
Vis, cSt @ 60° C.: 4.73
Concarbon residue, wt %: 0.65-1.08
Asphaltenes, wt %: 0.05
Wax, wt %: 27
Rvp @ 100° F., psi: 2.5
V/Ni, ppm: 2/2
Nitrogen, wt %: 0.067
Salt as NaCl, mg/l.: 22
$C_4$ & lighter, vol %: 0.15
Acid No., mgKOH/g: 0.05

**Light naphtha ($C_5$-95° C.)**
Yield on crude, vol %: 2.3
Density @ 15° C., kg/l.: 0.683
Sulfur, wt %: 0.001
Mecaptan sulfur, wt %: 0.0002
Paraffins, wt %: 75.2
Naphthenes, wt %: 18.4
Aromatics, wt %: 6.4
n-paraffins, wt %: 42.0

**Light naphtha ($C_5$-149° C.)**
Yield on crude, vol %: 10.1
Density @ 15° C., kg/l.: 0.729
Sulfur, wt %: 0.001
Mercaptan sulfur, wt %: 0.0002
Paraffins, wt %: 60.5
Naphthenes, wt %: 31.3
Aromatics, wt %: 8.2
n-paraffins, wt %: 34.9

**Heavy naphtha (95-175° C.)**
Yield on crude, vol %: 12.3
Density @ 15° C., kg/l.: 0.7505
Sulfur, wt %: 0.001

Mercaptan sulfur, wt %: 0.0002
Paraffins, wt %: 59.0
Naphthenes, wt %: 31.2
Aromatics, wt %: 9.8
n-paraffins, wt %: 33.7

**Kerosine (149-232° C.)**
Yield on crude, vol %: 14.35
Density @ 15° C., kg/l.: 0.7785
Sulfur, wt %: 0.001
Mercaptan sulfur, wt %: 0.0002
Vis., cSt @ 40° C.: 1.12
Vis., cSt @ 60° C.: 0.88
Acid No., mgKOH/g: 0.041
Aromatics, vol %: 13.0
Smoke pt., mm: 35
Freeze pt., °C.: −49.0

**Gas oil (232-342° C.)**
Yield on crude, vol %: 23.05
Density @ 15° C., kg/l.: 0.818
Sulfur, wt %: 0.016
Vis., cSt @ 50° C.: 2.67
Vis., cst @ 80° C.: 1.30
Cloud pt., °C.: −3
Pour pt., °C. −3
Wax, wt %: 9.5
Total nitrogen, ppm wt: 26
Acid No., mgKOH/g: 0.01
Aniline pt., °C.: 65.8
Cetane index: 47.6

**Residue (342° C.+)**
Yield on crude, vol %: 52.35
Density @ 15° C., kg/l.: 0.868
Sulfur, wt %: 0.04
Vis., cSt @ 50° C.: 29.6
Pour pt., °C.: 51
Wax, wt %: 49
Total nitrogen, ppm: 590
Concarbon residue, wt %: 1.2
Asphaltenes, wt %: 0.05
V/Ni, ppm wt: 2/2

**Residue (369° C.+)**
Yield on crude, vol %: 46.75
Density @ 15° C., kg/l.: 0.872
Sulfur, wt %: 0.045
Vis., cSt @ 50° C.: 37.9
Vis., cSt @ 60° C.: 26.6
Vis., cSt @ 80° C.: 14.8
Vis., cSt @ 100° C.: 9.21
Pour pt., °C.: 54
Wax, wt %: 50
Total nitrogen, ppm: 640
Acid No., mgKOH/g: 0.05
Concarbon residue, wt %: 1.3
Asphaltenes, wt %: 0.05
V/Ni, ppm wt: 2/2
Saturates, wt %: 75
Aromatics, wt %: 21
Resins A, wt %: 4

**Residue (509° C.+)**
Yield on crude, vol %: 17.8
Density @ 15° C., kg/l.: 0.9045
Sulfur, wt %: 0.065
Vis., cSt @ 100° C.: 32
Vis., cSt @ 120° C.: 19.6
Wax, wt %: 47
Total nitrogen, ppm: 1,210
Concarbon residue, wt %: 3.10
Asphaltenes, wt %: 0.05
V/Ni, ppm wt: 2/2

**Residue (550° C.+)**
Yield on crude, vol %: 14.2
Density @ 15° C., kg/l.: 0.9045
Sulfur, wt %: 0.065
Vis., cSt @ 100° C.: 42.9
Vis., cSt @ 120° C.: 25.7
Vis., cSt @ 150° C.: 13.9
Penetration @ 25° C., mm/10: 214
Softening pt., °C.: 56
Total nitrogen, ppm: 1,350
Concarbon residue, wt %: 3.8
Asphaltenes, wt %: 0.05
V/Ni, ppm wt: 2/2
Saturates, wt %: 58
Aromatics, wt %: 15
Resins A, wt %: 6
Resins B, wt %: 21

## The author...

Du

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## Dai Hung (Big Bear)

*Not yet in production*

**Crude**
Gravity, °API: 36.9
Sulfur, wt %: 0.08
Pour pt., °C.: 27
Vis., cSt @ 40° C.: 3.61
Vis., cSt @ 50° C.: 2.94
Vis., cSt @ 60° C.: 2.94
Concarbon residue, wt %: 0.70
Asphaltenes, wt %: 0.07
Wax, wt %: 26
V/Ni, ppm: 2/2
Nitrogen, wt %: 0.028
$C_4$ & lighter, vol %: 0.90
Acid No., mgKOH/g: 0.27

**Light naphtha ($C_5$-95° C.)**
Yield on crude, vol %: 5.55
Density @ 15° C., kg/l.: 0.7185
Sulfur, wt %: 0.001
Mecaptan sulfur, wt %: 0.0002
Paraffins, wt %: 51.5
Naphthenes, wt %: 28.8
Aromatics, wt %: 19.7
n-paraffins, wt %: 21.4

**Light naphtha ($C_5$-149° C.)**
Yield on crude, vol %: 17.8
Density @ 15° C., kg/l.: 0.7685
Sulfur, wt %: 0.002
Mercaptan sulfur, wt %: 0.0002
Paraffins, wt %: 33.6
Naphthenes, wt %: 30.8
Aromatics, wt %: 35.6
n-paraffins, wt %: 14.7

**Heavy naphtha (95-175° C.)**
Yield on crude, vol %: 17.1
Density @ 15° C., kg/l.: 0.7955
Sulfur, wt %: 0.003
Mercaptan sulfur, wt %: 0.0002
Paraffins, wt %: 29.5
Naphthenes, wt %: 27.5
Aromatics, wt %: 43.0
n-paraffins, wt %: 13.5

**Kerosine (149-232° C.)**
Yield on crude, vol %: 14.7
Density @ 15° C., kg/l.: 0.8155
Sulfur, wt %: 0.007
Mercaptan sulfur, wt %: 0.0002
Vis., cSt @ 40° C.: 1.08
Vis., cSt @ 60° C.: 0.89
Acid No., mgKOH/g: 0.143
Aromatics, vol %: 32.7
Smoke pt., mm.: 17
Freeze pt., °C.: −54.5

**Gas oil (232-342° C.)**
Yield on crude, vol %: 27.15
Density @ 15° C., kg/l.: 0.852
Sulfur, wt %: 0.068
Vis., cSt @ 50° C.: 2.61
Vis., cSt @ 80° C.: 1.26
Cloud pt., °C.: −2
Pour pt., °C. −3
Wax, wt %: 9.5
Total nitrogen, ppm wt: 24
Acid No., mgKOH/g: 0.21
Aniline pt., °C.: 68.7
Cetane index: 48.8

**Residue (342° C.+)**
Yield on crude, vol %: 39.45
Density @ 15° C., kg/l.: 0.8775
Sulfur, wt %: 0.12
Pour pt., °C.: 54
Wax, wt %: 54
Total nitrogen, ppm: 490
Concarbon residue, wt %: 1.7
Asphaltenes, wt %: 0.16
V/Ni, ppm wt: 2/2

**Residue (369° C.+)**
Yield on crude, vol %: 33.65
Density @ 15° C., kg/l.: 0.8815
Sulfur, wt %: 0.12
Pour pt., °C.: 57
Wax, wt %: 55
Total nitrogen, ppm: 550
Acid No., mgKOH/g: 0.23
Concarbon residue, wt %: 2.0
Asphaltenes, wt %: 0.19
V/Ni, ppm wt: 2/2
Saturates, wt %: 85
Aromatics, wt %: 9
Resins A, wt %: 2
Resins B, wt %: 4

**Residue (509° C.+)**
Yield on crude, vol %: 7.0
Density @ 15° C., kg/l.: 0.9675
Sulfur, wt %: 0.27
Vis., cSt @ 100° C.: 77.7
Vis., cSt @ 120° C.: 39.8
Penetration @ 25° C., mm/10: 5
Softening pt., °C.: 59.5
Wax, wt %: 38
Total nitrogen, ppm: 1,600
Concarbon residue, wt %: 8.4
Asphaltenes, wt %: 0.85
V/Ni, ppm wt: 2/11

**Residue (550° C.+)**
Yield on crude, vol %: 5.0
Density @ 15 C., kg/l.: 0.9895
Sulfur, wt %: 0.31
Vis., cSt @ 100° C.: 220
Vis., cSt @ 120° C.: 96.1
Vis., cSt @ 150° C.: 36.7
Penetration @ 25° C., mm/10: 31
Softening pt., °C.: 60.5
Total nitrogen, ppm: 1,900
Concarbon residue, wt %: 11.5
Asphaltenes, wt %: 1.1
V/Ni, ppm wt: 2/15
Saturates, wt %: 15
Aromatics, wt %: 53
Resins A, wt %: 24
Resins B, wt %: 8

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LOU ANN THRASH
Director of Editorial Surveys
The Oil & Gas Journal

# 1990 Worldwide Petrochemical Survey

## ABU DHABI

### RUWAIS FERTILIZER INDUSTRIES

**Ruwais.** Feed: associated gas. Products: ammonia (1,050 mt/d), urea (1,500 mt/d).

## ALGERIA

### SONATRACH

**Arzew.** Feed: natural gas. Products: ammonia (1,000 mt/d), aromatics mix (1,152 mt/d), benzene (273 mt/d), ethylene (364 mt/d), formaldehyde (61 mt/d), methanol (303 mt/d), orthoxylene (115 mt/d), ld polyethylene (145 mt/d), polyvinyl chloride (106 mt/d), toluene (5,000 mt/d), urea (400 mt/d), xylene mix (748 mt/d)

## ARGENTINA

### ATANOR

**Baradero, Buenos Aires.** Feed: ethyl alcohol. Products: acetaldehyde (8,700 mt/y), acetic acid (11,050 mt/y), acetic anhydride (2,400 mt/y), acetates (12,600 mt/y).

**Munro, Buenos Aires.** Feed: acetates, ethyl alcohol, methanol. Products: acetaldehyde (2,405 mt/y), acetic acid (3,210 mt/y), acetone (1,400 mt/y), ethanol (11,200 mt/y), formaldehyde (25,680 mt/y).

**Río Tercero, Córdoba.** Feed: brine, gas. Products: acetaldehyde (11,400 mt/y), acetic acid (15,600 mt/y), acetic anhydride (2,400 mt/y), formaldehyde (31,000 mt/y), methanol (12,250 mt/y).

### CARBOCLOR INDUSTRIAS QUIMICAS

**Campana.** Feed: $C_3$ and $C_4$ refinery cuts. Products: acetone (12,000 mt/y), isopropanol (48,000 mt/y).

### CASCO SAIC

**Pilar.** Feed: natural gas. Products: formaldehyde (38,000 mt/y), methanol (20,000 mt/y).

### DIRECCION GENERAL DE FABRICACIONES MILITARES

**Campana.** Feed: hydrocarbon fractions. Products: aromatics mix, normal paraffins, toluene, xylene mix, solvents.

**Rio Tercero, Cordoba.** Feed: natural gas. Product: ammonia (12,000 mt/y).

### DUPERIAL SAIC

(subsidiary of Imperial Chemical Industries)

**San Lorenzo.** Feed: refinery products, xylene. Products: ethylene (21,000 mt/y), phthalic anhydride (12,400 mt/y), ld polyethylene (20,000 mt/y).

### ELECTROCLOR SAIC

**Capitán Bermúdez, Santa Fe.** Feed: calcium carbide, chlorine, hydrogen. Products: acetylene (15,000 mt/y), ammonia (3,000 mt/y), polyvinyl chloride (32,000 mt/y), vinyl chloride (33,500 mt/y).

### IPAKO-industrias Petroquimicas Argentinas

(owned by private Argentine interests).

**Ensenada.** Feed: refinery gases. Products: ethylene (15,000 mt/y), ld polyethylene (14,000 mt/y).

### MALEIC SA

**Ensenada, Buenos Aires.** Feed: n-butane. Product: maleic anhydride (10,000 mt/y).

### MONSANTO ARGENTINA SAIC

**Zarate.** Feed: styrene. Products: ABS (8,500 mt/y), polystyrene (40,000 mt/y).

### PASA PETROQUIMICA ARGENTINA

(owned by Amcorp SA, Anglo American Corp., Argentina Holdings Ltd., Uniroyal Chemical Co. Inc., Perez Companc)

**Campana.** Feed: natural gas. Products: ammonia (80,000 mt/y), urea (130,000 mt/y).

**Puerto Gral. San Martin, Santa Fe.** Feed: butane, naphtha, propane. Products: aromatics (180,000 mt/y), butadiene (37,000 mt/y), ethylbenzene (66,000 mt/y), ethylene (24,000 mt/y), styrene (70,000 mt/y), SBR (53,000 mt/y).

### PETROQUIMICA BAHÍA BLANCA SAIC

**Bahia Blanca.** Feed: ethane. Products: ethylene (201,000 mt/y).

### PETROQUIMICA GENERAL MOSCONI

**Ensenada, Buenos Aires.** Feed: naphtha. Products: aromatics mix (250,000 mt/y), benzene (120,000 mt/y), cyclohexane (80,000 mt/y), orthoxylene (25,000 mt/y), paraxylene (40,000 mt/y), toluene (120,000 mt/y), xylene mix (10,000 mt/y).

### POLISUR

**Bahia Blanca.** Feed: ethylene. Product: ld polyethylene (190,000 mt/y).

### SUDAMTEX SA

**Azul, Buenos Aires.** Feed: dimethyl terephthalate, ethylene glycol. Products: methanol (1,650 mt/y), polyester (6,500 mt/y).

## AUSTRALIA

### ALTONA PETROCHEMICAL CO. LTD.

(50% Esso Australia Ltd., 50% Mobil Oil Australia).

**Altona, Vic.** Feed: gas oil, ethane. Products: butadiene (17,000 mt/y), carbon black oil (50,000 mt/y), ethylene (170,000 mt/y), propylene (50,000 mt/y).

### AMPOL REFINERIES LTD.

**Lytton, Brisbane.** Feed: crude oil. Products: toluene (5,500 mt/y).

### AUSTRALIAN SYNTHETIC RUBBER CO. LTD.

(35% Esso Australia Ltd., 35% Mobil Oil Australia Ltd., 30% Goodyear Tire & Rubber Co. Ltd).

**Altona.** Feed: butadiene, styrene. Products: polybutadiene (10,000 mt/y), SBR (35,000 mt/y).

### BORDEN AUSTRALIA PTY. LTD.

**Brisbane, Gibson Island.** Feed: methanol. Product: formaldehyde (28,000 mt/y).

**Melbourne.** Feed: methanol. Product: formaldehyde (28,000 mt/y).

### CABOT AUSTRALIA PTY. LTD.

(100% Cabot Corp.)

**Altona, Vic.** Feed: petroleum residual. Product: carbon black (58,000 mt/y).

### CHEMPLEX AUSTRALIA LTD.

**West Footscray.** Feed: benzene, ethane, propylene. Products: acetone (12,200 mt/y), cumene (28,000 mt/y), ethylbenzene (130,000 mt/y), ethylene (35,000 mt/y), phenol (20,000 mt/y), unsaturated polyester (11,000 mt/y), polystyrene (27,000 mt/y), styrene (110,000 mt/y), ABS (19,000 mt/y), EPS (8,000 mt/y), SAN (10,000 mt/y), SBR latex (11,000 mt/y).

### COMPOL LTD.

(50% Mobil, 50% Exxon).

**Altona, Vic.** Feed: ethylene. Products: polyethylene (110,000 mt/y).

### CONTINENTAL CARBON AUSTRALIA PTY. LTD.

(49% affiliate of Witco Corp.—Concarb Div.)

**Kurnell, NSW.** Feed: creosote oil. Product: carbon black (30,000 mt/y).

### HOECHST AUSTRALIA LTD.

(owned 95% by Hoechst AG).

**Altona.** Feed: olefins. Products: hd polyethylene (75,000 mt/y), polypropylene (35,000 mt/y).

### ICI AUSTRALIA LTD.

**Botany, NSW.** Feed: LPG, light naphtha. Products: butadiene (23,000 mt/y), butylenes (23,000 mt/y), ethylene (250,000 mt/y), ethylene oxide (36,000 mt/y), ld polyethylene (90,000 mt/y), polypropylene (55,000 mt/y), propylene (95,000 mt/y), polyvinyl chloride (55,000 mt/y), vinyl chloride (60,000 mt/y).

**Laverton, Vic.** Feed: vinyl chloride. Product: polyvinyl chloride (55,000 mt/y).

**Rhodes.** Feed: ethylene, heptene, natural gas, naphthalene, propylene. Products: acetaldehyde (15,000 mt/y), acetic acid (20,000 mt/y), butanols (9,000 mt/y), iso-octanol (14,000 mt/y), phthalic anhydride (21,500 mt/y), vinyl acetate (14,000 mt/y), solvents (9,500 mt/y), plasticizers (32,500 mt/y).

### INCITEC LTD.

**Gibson Island, Queensland.** Feed: natural gas. Products: ammonia (245,000 mt/y), urea (245,000 mt/y).

**Newcastle, NSW.** Feed: natural gas. Product: ammonia (238,000 mt/y).

### KWINANA NITROGEN CO. PTY. LTD.

**Kwinana.** Feed: natural gas, refinery offgases. Product: ammonia (80,000 mt/y).

### SHELL CHEMICAL (AUSTRALIA) PTY. LTD.

**Clyde, N.S.W.** Feed: refinery gases. Product: polypropylene (35,000 mt/y).

**Geelong, Victoria.** Feed: naphtha, gasoline, refinery gases. Products: alkylbenzene (18,000 mt/y), toluene (20,000 mt/y),xylene mix (25,000 mt/y), polypropylene (75,000 mt/y).

## AUSTRIA

### CHEMIE HOLDING AG

**Enns.** Feed: propylene. Product: acrylonitrile (75,000 mt/y).

**Linz.** Feed: benzene, orthoxylene. Products: maleic anhydride (19,000 mt/y), melamine (35,000 mt/y), phthalic anhydride (37,000 mt/y), urea (400,000 mt/y), plasticizers (38,000 mt/y).

### HALVIC KUNSTOFFWERKE GmbH

**Hallein.** Feed: vinyl chloride monomer. Product: polyvinyl chloride.

### OMV AG

**Schwechat.** Feed: butane, gasoil, naphtha. Products: butadiene (50,000 mt/y), ethylene (320,000 mt/y), propylene (160,000 mt/y).

### PETROCHEMIE DANUBIA GmbH

($66^{2}/_{3}$% OMV AG, $33^{1}/_{3}$% Co. Ltd. Holding AG)

**Schwechat.** Feed: ethylene, propylene. Products: polyethylene (330,000 mt/y), polypropylene (230,000 mt/y).

**VIANOVA KUNSTHARZ AG**
**Werndorf.** Feed: alcohols, acids, oils. Products: acrylics and alkyds, unsaturated polyesters, water soluble resins (40,000 mt/y).

## BAHRAIN

**GULF PETROCHEMICAL INDUSTRIES CO.**
**Manama.** Feed: methane. Products: ammonia (438,000 mt/y), methanol (438,000 mt/y).

## BANGLADESH

**ZIA FERTILIZER CO. LTD.**
(Bangladesh Chemical Industries Corp.)
**Ashuganj.** Feed: natural gas. Products: ammonia (930 mt/d), urea (1,600 mt/d).

## BELGIUM

**AMOCO CHEMICAL CO.**
**Geel.** Feed: metaxylene, methanol, paraxylene, propylene. Products: isophthalic acid (39,900 mt/y), polypropylene (199,600 mt/y), terephthalic acid (142,900 mt/y).

**ARCO CHEMICAL.**
**Rieme.** Product: polyols (77,000 mt/y).

**BASF ANTWERPEN NV**
**Antwerp.** Feed: ethylene, benzene, cyclohexane. Products: caprolactam (150,000 mt/y), ethylene glycol (160,000 mt/y), ethylene oxide (150,000 mt/y), polystyrene (145,000 mt/y), polyvinyl chloride (100,000 mt/y), vinyl chloride (160,000 mt/y).

**BAYER ANTWERPEN NV**
**Antwerp and Kallo.** Feed: cyclohexane. Products: caprolactam (110,000 mt/y), polyamide (10,000 mt/y).

**BP CHEMICALS BELGIUM**
**Antwerp.** Products: glycols (130,000 mt/y), ethylene oxide (115,000 mt/y), ld polyethylene (130,000 mt/y), esters-ethers (75,000 mt/y).

**DOW CHEMICAL**
**Tessenderlo.** Products: polystyrene, hd polyethylene.

**DSM**
**Limburgse Vinyl MNV**
(joint venture with Entreprise Minière et Chimique)
**Tessenderlo.** Feed: ethylene, C12 HCl. Product: vinyl chloride (450,000 mt/y).

**EUROGRAN**
(100% Atochem Belgium)
**Wetteren.** Product: polyvinyl chloride compounds (13,000 mt/y).

**EXXON CHEMICAL BELGIUM**
**Antwerp.** Feed: hydrocarbons. Products: solvents (680,000 mt/y).
**Meerhout.** Feed: ethylene. Product: polyethylene (315,000 mt/y).
**Zwijndrecht.** Feed: ethylene. Product: EVA copolymers (250,000 mt/y).

**FINAMONT SA**
(50% Petrofina, 50% Montedipe)
**Feluy.** Feed: styrene. Products: polystyrene mass (70,000 mt/y), expandable polystyrene (30,000 mt/y).

**HIMONT BELGIUM**
**Feluy.** Feed: propylene. Product: polypropylene (260,000 mt/y).

**KEMIRA SA.**
**Tertre.** Feed: natural gas. Products: ammonia (390,000 mt/y), urea (230,000 mt/y).

**MONTEFINA.**
(50% Himont Inc., 50% Petrofina)
**Feluy.** Feed: propylene. Products: polypropylene (300,000 mt/y).

**NESTE POLYPROPYLENE NV**
**Beringen.** Feed: propylene. Product: polypropylene (240,000 mt/y).

**PHILLIPS 66 CO.**
**Tessenderlo.** Feed: olefins. Product: petrosulfur compounds (13,000 mt/y).

**POLYSAR BELGIUM NV**
**Antwerp.** Feed: isobutylene. Products: butyl rubber (85,000 mt/y).

**SOLVIC SA**
**Jemeppe-sur-Sambre.** Feed: ethylene. Products: vinyl chloride, polyvinyl chloride.

**UCB-FTAL**
**Ostend.** Feed: alcohols, cyclohexanol, orthoxylene, phenol. Products: phthalic anhydride (80,000 mt/y), phthalates (65,000 mt/y).

## BRAZIL

**ALBA AMAZÓNIA SA**
**Manaus.** Feed: methanol. Product: formaldehyde (30,000 mt/y).

**ALBA QUÍMICA SA**
**Cotia, S.P.** Feed: ethanol, methanol. Products: acetaldehyde (7,200 mt/y), formaldehyde (25,200 mt/y).
**Cubatão, S.P.** Feed: methanol, naphtha. Products: formaldehyde (45,400 mt/y), methanol (33,600 mt/y).
**Curitiba, P.R.** Feed: methanol. Products: formaldehyde (45,400 mt/y).

**BANN QUÍMICA SA**
**Ermelino Matarazzo, SP.** Feed: aniline. Product: rubber chemicals (12,800 mt/y).
**Paulinia, SP.** Feed: benzene, naphtha. Product: aniline (6,000 mt/y).

**CAPUAVA CARBONOS INDUSTRIAIS SA**
**Mauá, São Paulo.** Feed: ethylene tar. Product: carbon black (57,000 mt/y).

**CELBRAS QUIMICA E TEXTIL SA**
**Aratu, Bahia.** Feed: dimethyl terephthalate, glycol. Product: polyester (6,000 mt/y).
**Camaçari, Bahia.** Feed: acrylonitrile, maleic anhydride, dimethylformamide.–Product: acrylics (14,000 mt/y).
**Poços de Caldas.** Feed: glycol, terephthalic acid. Product: polyester (33,000 mt/y).

**CIA. DE CARBONOS COLOIDAIS**
**Candeias, Bahía.** Feed: heavy aromatic hydrocarbons. Product: carbon black (56,000 mt/y).

**CIQUINE**—Cia. Indústrias Químicas do Nordeste
**Camaçari, Bahía.** Feed: benzene, orthoxylene, phthalic anhydride, 2-ethyl hexanol, propylene. Products: maleic anhydride (6,400 mt/y), phthalic anhydride (28,000 mt/y), plasticizers (10,000 mt/y), propylene (38,800 mt/y).

**COMPANHIA BRASILEIRA DE ESTIRENO**
**Cubatão, S.P.** Feed: benzene, ethanol, ethylene. Products: ethylene (4,800 mt/y), ethylbenzene (100,000 mt/y), ethylchloride (640 mt/y), styrene (100,000 mt/y), toluene (3,200 mt/y).

**COMPANHIA BRASILEIRA DE POLIURETANOS. Camacari.** Product: diphenyl methane diisocyanate (12,000 mt/y).

**COPAMO**—Consórcio Paulista De Monómero SA
**Santo André.** Feed: ethylene. Product: vinyl chloride (130,000 mt/y).

**COPENE**
**Camaçari, Bahía.** Feed: gas oil, naphtha. Products: aromatics (200,000), benzene (222,000 mt/y), butadiene (79,000 mt/y), butylenes (46,000 mt/y), ethylene (460,000 mt/y), orthoxylene (70,000 mt/y), MTBE (68,000 mt/y), paraxylene (130,000 mt/y), propylene (272,000 mt/y), solvent (45,000 mt/y), toluene (30,000 mt/y), xylene mix (41,000 mt/y).

**COPENOR**
**Camaçari.** Feed: methanol. Product: formaldehyde (43,000 mt/y).

**COPERBO**
**Cabo, Pernambuco.** Feed: ethyl alcohol, butadiene, styrene. Products: acetaldehyde (50,000 mt/y), acetic acid (70,000 mt/y), ethylene (36,000 mt/y), polybutadiene (78,000 mt/y), SBR (18,000 mt/y), thermoplastic elastomer (4,000 mt/y), vinyl acetate (80,000 mt/y).

**COPESUL**
**Triunfo, RGS.** Feed: naphtha. Products: benzene (199,000 mt/y), butadiene (96,000 mt/y), ethylene (561,000 mt/y), propylene (300,000 mt/y), toluene (22,000 mt/y), xylene mix (72,000 mt/y).

**ESTIRENO DO NORDESTE SA**
**Camaçari, Bahia.** Feed: benzene, ethylene. Products: ethylbenzene (180,000 mt/y), polystyrene (100,000 mt/y), styrene (150,000 mt/y), toluene (800 mt/y).

**FISIBA**
**Camaçari, Bahia.** Feed: acrylonitrile. Product: acrylics (1,100 mt/y).

**HIMONT DO BRASIL**
**Triunfo.** Feed: propylene. Product: polypropylene (75,000 mt/y).

**INDÚSTRIAS QUÍMICAS ELETRO CLORO SA**
**Santo André.** Feed: ethylene, vinyl chloride. Products: ethylene (10,500 mt/y), hd polyethylene (82,000 mt/y), polyvinyl chloride (156,000 mt/y), vinyl chloride (34,000 mt/y).

**METANOR SA—Metanol do Nordeste**
**Camaçari, Bahia.** Feed: carbon dioxide, natural gas. Product: methanol (70,400 mt/y).

**NITRIFLEX SA**
**Duque de Caxias, Rio de Janeiro.** Feed: acrylonitrile, butadiene, styrene. Products: ABS-MBS-SAN (21,000 mt/y), resins, rubber (21,400 mt/y).
**Triunfo, RS.** Feed: ENB, ethylene, propylene. Product: ethylene-propylene (10,000 mt/y).

**NITROCARBONO SA**
**Camacari.** Feed: ammonia, benzene, hydrogen. Products: caprolactam (53,000 mt/y), cyclohexane (55,000 mt/y), cyclohexanone (47,700 mt/y).

**NITROFÉRTIL**
**Camaçari, Bahía.** Feed: natural gas. Products: ammonia (1,043 mt/d), urea (800 mt/d), hydrogen (22 mt/d), carbon dioxide (200 mt/d).
**Laranjeiras, Sergipe.** Feed: natural gas. Products: ammonia (907 mt/d), urea (1,100 mt/d).

**OXITENO SA INDÚSTRIA E COMÉRCIO**
**Camaçari, RS.** Feed: ethylene. Products: ethylene glycol (122,130 mt/y), ethylene oxide (122,500 mt/y).
**Itaguaí, RJ.** Feed: Ethylene. Products: ethylene glycol (8[illegible],000 mt/y), ethylene oxide (100,000 mt/y).
**Mauá, São Paulo.** Feed: ethylene. Products: ethylene glycol (25,000 mt/y), ethylene oxide (40,000 mt/y).
**Troiunfo, RS.** Feed: propylene. Products: isopropanol (20,000 mt/y)

**PETROFLEX**
**Duque de Caxias.** Feed: butadiene, ethylbenzene, styrene. Products: styrene (60,000 mt/y), SBR (185,000 mt/y).
**Triunfo.** Feed: benzene, butadiene, ethylene, styrene. Products: ethylbenzene (140,000 mt/y), SBR (40,000 mt/y).

**PETROQUÍMICA TRIUNFO SA**
**Triunfo, Rio Grande do Sul.** Feed: ethylene. Product: ld polyethylene (130,000 mt/y).

**PETROQUÍMICA UNIÃO SA**

**Santo André, Capuava.** Feed: naphtha. Products: alkybenzene (12,000 mt/y), aromatics (312,000 mt/y), benzene (170,000 mt/y), butadiene (50,000 mt/y), butylenes (59,000 mt/y), ethylene (360,000 mt/y), orthoxylene (35,000 mt/y), propylene (204,000 mt/y), resins (10,000 mt/y), toluene (40,000 mt/y), xylene mix (55,000 mt/y), pyrolysis gasoline (103,000 mt/y).

**POLIALDEN PETROQUÍMICA SA**

**Camaçari, Bahía.** Feed: ethylene. Product: hd polyethylene (100,000 mt/y).

**POLIBRASIL**

**Mauá, São Paulo.** Feed: propylene. Product: polypropylene (90,000 mt/y).

**POLIOLEFINAS SA**

**Capuava, Santo André.** Feed: ethylene, vinyl acetate. Product: ethylene-vinyl acetate copolymer and ld polyethylene (110,000 mt/y).

**Triunfo, Rio Grande do Sul.** Feed: ethylene. Product: ld polyethylene (160,000 mt/y).

**POLISUL PETROQUIMICA SA**

(33% Hoechst AG, 33% Ipiranga, 33% petroquisa)

**Triunfo.** Feed: ethylene. Product: hd polyethylene (160,000 mt/y).

**POLITENO**

**Camaçari, Bahia.** Feed: ethylene, vinyl acetate. Product: ld polyethylene (130,000 mt/y).

**PRONOR PETROQUÍMICA SA**

**Camaçari.** Feed: methanol, natural gas, paraxylene, toluene. Products: dimethyl terephthalate (78,000 mt/y), toluene di-isocyanate (42,000 mt/y).

**PROSINT PRODUTOS SINTÉTICOS SA**

**Rio de Janeiro.** Feed: natural gas. Product: methanol (42,500 mt/y).

**RHÓDIA SA**

**Paulínia.** Feed: alcohol, cumene, paraxylene. Products: acetaldehyde (58,500 mt/y), acetic acid (73,000 mt/y), acetone (71,000 mt/y), bisphenol A (17,900 mt/y), cyclohexane (400 mt/y), isopropanol (7,700 mt/y), phenol (115,000 mt/y), terephthalic acid (110,000 mt/y-produced by Rhodiaco).

**Santo André.** Feed: alcohol. Product: acetic anhydride (26,000 mt/y).

**SALGEMA SA**

**Maceió, Alagoas.** Feed: alcohol. Products: ethylene dichloride (420,000 mt/y), ethylene (100,000 mt/y).

**ULTRAFÉRTIL SA**

**Araucária.** Feed: anhydrous ammonia, asphaltic residue, syngas. Product: ammonia (396,000 mt/y).

**Piaçaguera.** Feed: naphtha, refinery off gases. Product: ammonia (149,820 mt/y).

**UNION CARBIDE DO BRASIL LTDA.**

**Cubatão, São Paulo.** Feed: ethylene. Products: ethanol (92,000 mt/y), ethylene (40,000 mt/y), ld polyethylene (128,000 mt/y).

**USIMINAS SA**

(Usinas Siderúrgicas de Minas Gerais)

**Ipatinga.** Feed: coke oven gas, coal tar. Products: ammonia (12.3 mt/d), benzene (33.3 mt/d), naphthalene (19 mt/d), toluene (5.3 mt/d), xylene mix (0.7 mt/d).

## CANADA

**ALBERTA GAS ETHYLENE CO. LTD.**

**Joffre, Alberta.** Feed: ethane. Products: ethylene (1,457,000 mt/y), propylene (45,000 mt/y).

**BASF CANADA INC.**

**Cornwall, Ontario.** Feed: orthoxylene. Products: phthalic anhydride (40 mt/y), plasticizers (30 mt/y).

**B.F.GOODRICH CANADA INC.**

**Fort Saskatchewan, Alta.** Product: polyvinyl chloride (100,000 mt/y).

**Niagara Falls, Ont.** Product: polyvinyl chloride resins (95,000 mt/y).

**Scotford, Alta.** Product: polyvinyl chloride resins.

**Shawinigan, Quebec.** Product: polyvinyl chloride resins (57,000 mt/y).

**BORDEN CHEMICAL CANADA**

**Laval, Quebec.** Feed: methanol. Product: formaldehyde (25,000 mt/y).

**Edmonton, Alberta.** Feed: methanol. Product: formaldehyde (35,000 mt/y).

**GE PLASTICS CANADA LTD.**

**Cobourg, Ont.** Product: ABS (30,000 mt/y).

**CABOT CANADA LTD.**

**Sarnia, Ont.** Feed: heavy fuel oil. Product: carbon black (80,000 mt/y).

**CANADIAN FERTILIZERS LTD.**

**Medicine Hat, Alta.** Feed: natural gas. Product: ammonia (816,500 mt/y), urea (544,000 mt/y).

**CANCARB LTD.**

**Medicine Hat, Alta.** Feed: natural gas. Product: carbon black (30,000 mt/y).

**CELANESE CANADA LTD.**

**Clover Bar (near Edmonton).** Feed: butanes, ethylene, natural gas. Products: acetaldehyde (1,700 mt/y), acetic acid (72,000 mt/y), acetic anhydride (27,000 mt/y), acetone (1,200 mt/y), formaldehyde (38,000 mt/y), methanol (765,000 mt/y), vinyl acetate (52,000 mt/y).

**C-I-L INC.**

**Courtright, Ont.** Feed: natural gas. Product: ammonia (720,000 mt/y), urea (140,000 mt/y).

**Edmonton, Alta.** Feed: ethylene. Product: ld polyethylene, ethylene vinyl acetate (75,000 mt/y).

**COLUMBIAN CHEMICALS CO.**

**Hamilton, Ont.** Feed: heavy aromatic hydrocarbons. Product: furnace carbon black (70,000 mt/y).

**COMINCO LTD.**

**Carseland, Alta.** Feed: natural gas. Product: ammonia (410,000 mt/y), urea (575,000 mt/y).

**Joffre, Alta.** Feed: nitrogen, hydrogen. Product: ammonia (352,400 mt/y).

**COMMERCIAL ALCOHOLS LTD.**

**Varennes, Que.** Feed: ethylene. Product: ethanol (55,000 mt/y).

**CYANAMID CANADA INC.**

**Niagara Falls, Ont.** Feed: natural gas. Products: ammonia (210,000 mt/y).

**DOW CHEMICAL OF CANADA INC.**

**Fort Saskatchewan, Alta.** Feed: ammonia, caustic, chlorine, ethylene, hydrogen, natural gas, oxygen. Products: ethanolamines, ethylene dichloride, ethylene glycol, ethylene oxide, lld polyethylene, vinyl chloride.

**Sarnia, Ont.** Feed: benzene, butadiene, caustic, chlorine, ethylene, hydrogen, natural gas, propylene. Products: ethylbenzene, ld and hd polyethylene, polystyrene, propylene glycol, propylene oxide, styrene, vinyl chloride, SB latex.

**Varennes, Que.** Feed: butadiene, styrene. Product: SB latex.

**DU PONT CANADA INC.**

**Corunna, Ont.** Feed: ethylene. Product: ld & hd polyethylene (235,000 mt/y).

**ESSO CHEMICAL CANADA**

(Division of Imperial Oil)

**Ioco, B.C.** Feed: naphtha. Product: xylene (7,000 mt/y).

**Redwater, Alberta.** Feed: natural gas. Products: ammonia (825,000 mt/y), urea (525,000 mt/y).

**Sarnia, Ontario.** Feed: natural gas liquids, refinery off gases. Products: benzene (100,000 mt/y), butadiene (8,000 mt/y), butylenes (40,000 mt/y), carbon black (65,005 mt/y), ethylene (220,000 mt/y), polyethylene (135,000 mt/y), polyvinyl chloride (90,000 mt/y), propylene (40,000 mt/y), toluene (70,000 mt/y), xylene (30,000 mt/y).

**ETHYL CANADA INC.**

**Corunna, Ont.** Feed: ethylene, anhydrous hydrogen chloride. Product: ethylchloride (30,000 mt/y).

**HIMONT CANADA INC.**

**Varennes, Quebec.** Feed: propylene. Product: polypropylene (135,000 mt/y).

**NITROCHEM INC.**

**Maitland, Ontario.** Feed: natural gas. Products: ammonia (90,000 mt/y).

**NOVA PETROCHEMICALS INC.**

**Cambridge, Ont.** Feed: styrene. Product: polystyrene (37,000 mt/y).

**Corunna, Ont.** Feed: heavy atm. gas oil, vac gas oil, naphtha from crude and condensate, NGLS. Products: aromatics mix (125,000 mt/y), benzene (140,000 mt/y), butadiene (90,000 mt/y), butylenes (130,000 mt/y), ethylene (455,000 mt/y), propylene (330,000 mt/y).

**Montreal.** Feed: styrene. Product: polystyrene (38,000 mt/y).

**Sarnia, Ont.** Feed: acrylonitrile, benzene, $C_4$ streams, ethylene, ethylbenzene, light oil. Products: styrene (270,000 mt/y), SBR-NBR-BR-IIR (262,000 mt/y), toluene (13,000 mt/y).

**Joffre, Alberta.** Feed: ethylene. Product: lld polyethylene (385,000 mt/y).

**Medicine Hat, Alberta.** Feed: natural gas. Product: methanol (860,000 mt/y), ethylene (1,457,00 mt/y).

**Sarnia, Ont.** Feed: ethylene. Products: ld-hd polyethylene (200,000 mt/y).

**OCELOT AMMONIA CO.**

**Kitimat, B.C.** Feed: natural gas. Products: ammonia (550 mt/d), methanol (1,200 mt/d).

**PETRO-CANADA PRODUCTS**

**Montreal.** Feed: crude oil. Products: benzene (115,000 mt/y), toluene (110,000 mt/y), xylene mix (115,000 mt/y).

**RECOCHEM INC.**

**Montreal, Que.** Products: benzene, naphthalene, toluene, xylene.

**REICHHOLD LTD.**

**North Bay, Ont.** Feed: methanol. Product: formaldehyde (100,000 mt/y).

**Port Moody, B.C.** Feed: methanol. Product: formaldehyde (15,500 mt/y).

**Ste. Therese, Que.** Feed: methanol. Product: formaldehyde (55,000 mt/y).

**Thunder Bay, Ont.** Feed: methanol. Products: formaldehyde (55,000 mt/y).

**SHELL CANADA LTD.**

**Corunna, Ont.** Feed: reformate, propylene. Products: benzene (347,000 mt/y), polypropylene (170,000 mt/y), toluene (87,000 mt/y), xylene mix (73,000 mt/y).

**Montreal East, Que.** Feed: isopropyl alcohol. Product: acetone, $C_8$, oxysolvents (27,000 mt/y).

**Scotford, Alta.** Feed: benzene, ethylene. Product: styrene (380,000 mt/y).

**SHERRITT GORDON MINES LTD.**

**Fort Saskatchewan, Alta.** Feed: natural gas. Products: ammonia (490,000 mt/y), urea (393,000 mt/y).

**SIMPLOT CHEMICAL CO. LTD.**

**Brandon, Man.** Feed: natural gas. Products: ammonia (600 mt/d), urea (500 mt/d).

**SUNCHEM INC.**

**Sarnia.** Feed: reformate. Products: benzene (50,000 mt/y), orthoxylene (35,000 mt/y), toluene (195,000 mt/y), xylene mix (140,000 mt/y).

**UNION CARBIDE CANADA LTD.**

**Montreal East, Que.** Feed: ethylene. Products: ethylene glycol (82,000 mt/y), ethylene oxide (80,000 m/ty).

**Red Deer, Alta.** Product: ethylene glycol (250 mt/d).

## CHILE

**CAPE HORN METHANOL INC.**

**Punta Arenas.** Feed: natural gas. Product: methanol (750,000 mt/y).

**PETROX SA**

**Talcahuano.** Feed: naphtha. Product: ethylene (60,000 mt/y).

## CHINA

**CHINA PETRO-CHEMICAL INTERNATIONAL**

**Lanzhou, Ganzu Province.** Feed: naphtha, gas oils. Product: ethylene (80,000 mt/y).

## CHINA, TAIWAN

**ARCO CHEMICAL**

**Kaohsiung.** Products: polyols (27,500 mt/y), propylene glycols (10,000 mt/y).

**CHANG CHUN PETROCHEMICAL CO. LTD.**

**Miaoli.** Feed: acetic acid, n-isobutanol, vinyl acetate. Products: acetic acid (40,000 mt/y), polyvinyl alcohol (40,000 mt/y).

**CHANG CHUN PLASTICS CO. LTD.**

**Kaohsiung.** Feed: acrylonitrile, methanol, phenol, urea. Products: acrylamide (6,600 mt/y), formaldehyde (33,000 mt/y), polyacrylamide (18,000 mt/y), polyester (2,400 mt/y).

**Shin-Chu.** Feed: acetone, bisphenol, methanol, phenol. Products: formaldehyde (50,000 mt/y), paraformaldehyde (9,000 mt/y), resin (12,000 mt/y).

**CHINA AMERICAN PETROCHEMICAL CO. LTD.**

**Lin Yuan.** Feed: paraxylene. Product: terephthalic acid (750,000 mt/y).

**CHINA PETROCHEMICAL DEVELOPMENT CORP.**

**Kaohsiung.** Feed: cyclohexane, oleum. Products: caprolactam (50,000 mt/y).

**Ta-She.** Feed: ammonia, propylene, syngas. Product: acetic acid (60,000 mt/y), acrylonitrile (132,000 mt/y), methanol (66,000 mt/y).

**Toufen.** Feed: benzene, oleum. Product: caprolactam (50,000 mt/y), ethylene, (54,000 mt/y).

**CHINA SYNTHETIC RUBBER CORP.**
(Licensee of Witco Corp.—Concarb Div.)

**Kaohsiung.** •Feed: indigenous E.B. Product: carbon black (45,000 mt/y).

**CHINESE PETROLEUM CORP.**

**Kaohsiung.** Feed: crude. Products: benzene (318,500 mt/y), butadiene (128,000 mt/y), ethylene (899,000 mt/y), orthoxylene (60,000 mt/y), paraxylene (200,000 mt/y), propylene (475,600 mt/y), toluene (19,500 mt/y).

**CHIUNGLONG PETROCHEMICAL CO. LTD.**

**Kaohsiung.** Products: polypropylene glycol (22,000 mt/y), propylene glycol (5,560 mt/y), propylene oxide (15,000 mt/y).

**DAIREN CHEMICAL CORP.**

**Kaohsiung.** Feed: acetic acid, ethylene. Products: ethyl acetate (30,000 mt/y), ethylene vinyl acetate emulsion (23,000 mt/y), vinyl acetate (100,000 mt/y).

**FORMOSA PLASTICS CORP.**

**Koahsiung.** Products: acrylic acid-esters (50,000 mt/y), ethylene dichloride ( 200,000 mt/y), hd polyethylene (140,000 mt/y), polyvinyl chloride (760,000 mt/y), vinyl chloride (720,000 mt/y).

**FORMOSAN UNION CHEMICAL CORP.**

**Lin Yuan.** Feed: benzene, n-olefin, propylene tetramer. Product: alkylbenzene (90,000 mt/y).

**GRAND PACIFIC PETROCHEMICAL CORP.**

**Ta-She, Kaohsiung.** Feed: benzene, ethylene. Products: ABS (40,000 mt/y), polystyrene (230,000 mt/y), styrene (200,000 mt/y).

**HO TUNG CHEMICAL CORP.**

**Jen-Wu, Kaohsiung.** Feed: kerosine. Product: normal paraffins (40,000 mt/y).

**LEE CHANG YUNG CHEMICAL INDUSTRY CORP.**

**Hsin-Chu.** Products: dimethyl formamide (10,000 mt/y), dimethyl ether (3,500 mt/y), dimethyl sulfate (3,000 mt/y), formaldehyde (30,000 mt/y), hexamine (5,000 mt/y), methanol (60,000 mt/y), methyl amines (10,000 mt/y), paraformaldehyde (5,000 mt/y).

**Kaohsiung.** Products: formaldehyde (82,500 mt/y), formic acid (4,000 mt/y), melamine-formaldehyde resin (3,000 mt/y), pentaerythritol (8,000 mt/y), phenol-formaldehyde resin (5,000 mt/y), urea-formaldehyde resin (50,000 mt/y).

**Lin-Yuan.** Products: acetaldehyde (40,000 mt/y), acetone (20,000 mt/y), choline chloride (5,000 mt/y), diacetone alcohol (10,000 mt/y), ethyl acetate (40,000 mt/y), ethylene glycol ethers (10,000 mt/y).

**ORIENTAL UNION CHEMICAL CORP.**

**Kaoshiung.** Feed: ethylene. Products: ethylene glycol (150,000 mt/y), ethylene oxide (117,000 mt/y).

**TAIWAN FERTILIZER CO. LTD.**

**Miaoli.** Feed: natural gas. Products: ammonia (300,000 mt/y), urea (300,000 mt/d).

**TAIWAN POLYPROPYLENE CO. LTD.**

**Kaohsiung.** Feed: propylene. Product: polypropylene (180,000 mt/y).

**TAIWAN SYNTHETIC RUBBER CORP.**

**Ta-She, Kaohsiung.** Feed: butadiene, styrene. Products: polybutadiene (40,000 mt/y), thermoplastic elastomer (20,000 mt/y), SBR (100,000 mt/y).

**USI FAR EAST CORP.**

**Kaohsiung.** Feed: ethylene. Product: hd polyethylene (80,000 mt/y), ld polyethylene (140,000 mt/y), lld polyethylene (120,000 mt/y).

## COLOMBIA

**AMONIACO DEL CARIBE SA**

**Cartagena.** Feed: natural gas. Product: ammonia (350 mt/d).

**CABOT COLOMBIANA SA**
(subsidiary of Cabot Corp., Waltham, Mass.)

**Mamonal, Cartagena.** Feed: aromatic tar, natural gas. Product: carbon black (20,000 mt/y).

**CARBOQUIMICA SA.**

**Bogota.** Feed: orthoxylene, oxoalcohols, coal tar. Products: benzene (2,000 mt/y), naphthalene (1,000 mt/y), phthalic anhydride (12,000 mt/y), plasticizers (20,000 mt/y), solvents (3,000 mt/y), toluene (2,000 mt/y), xylene mix (2,500 mt/y).

**DOW COLOMBIANA SA**

**Cartagena.** Feed: styrene. Product: polystyrene (31,000 mt/y).

**EMPRESA COLOMBIANA DE PETROLEOS**

**Barrancabermeja.** Feed: crude oil, natural gas, refinery products.Products: alkylbenzene (15,000 mt/y), benzene (43,000 mt/y), cyclohexane (20,000 mt/y), ethylene (115,000 mt/y), orthoxylene (9,000 mt/y), propylene (5,500 mt/y), solvents (50,000 mt/y), toluene (20,000 mt/y), xylene mix (36,000 mt/y).

**PETROQUIMICA DE VENEZUELA SA**
(Pequiven)

**Barranquilla.** Feed: ammonia, sulfur, ciclo hexano. Product: caprolactam (23,500 mt/y).

**PETROQUIMICA COLOMBIANA SA**

**Mamonal, Cartagena.** Feed: vinyl chloride. Products: polyvinyl chloride (120,000 mt/y).

**POLICOLSA** (owned by Ecopetrol)

**Barrancabermeja.** Feed: ethylene. Product: ld polyethylene (55,000 mt/y).

**PRODUCTOS PETROQUIMICOS**

**Yumbo, Valle.** Feed: aromatic tar. Product: carbon black (18,000 mt/y).

## CZECHOSLOVAKIA

**CHEMICKE ZAVODY CSSP (CHEMICAL WORKS)**

**Litvinov.** Feed: crude oil. Product: ammonia (358,000 mt/y), benzene (164,000 mt/y), carbon black (1,000 mt/y), ethanol (54,000 mt/y), ethylbenzene (104,000 mt/y), ethylene (370,000 mt/y), oxoalcohols (47,000 mt/y), phenol (7,000 mt/y), propylene (182,000 mt/y), toluene (24,000 mt/y), urea (196,000 mt/y), xylene mix (31,300 mt/y), polyethylene (110,000 mt/y), polypropylene (110,000 mt/y).

## ECUADOR

**CIA. QUIMICA BORDEN EQUATORIANA SA**

**Quito.** Feed: methanol. Product: formaldehyde (9,200 mt/y).

## EGYPT

**AMERIA PETROLEUM REFINING CO.**

**Ameria.** Feed: naphtha. Products: alkylbenzene (40,000 mt/y), benzene (23,000 mt/y), toluene (4,000 mt/y).

**EGYPTIAN PETROCHEMICAL CO.**

**Ameria.** Feed: imported ethylene, sodium chloride. Products: polyvinyl chloride (80,000 mt/y), vinyl chloride (100,000 mt/y).

**EL NASR d'ENGRAIS et d'INDUSTRIES CHIMIQUES**

**Suez-Attaka.** Feed: natural gas. Product: ammonia (250 t/d).

**Talkha.** Feed: natural gas. Products: ammonia (396 t/d), urea (570,000 mt/y).

## FINLAND

**KEMIRA OY**

**Oulu.** Feed: peat. Products: ammonia (80,000 mt/y), formic acid (35,000 mt/y), urea (90,000 mt/y).

**NESTE OY**

**Kokemaki.** Feed: styrene. Product: polystyrene (10,000 mt/y).

**Porvoo.** Feed: alcohols, benzene, cumene, ethylene, FCC gas, glycols, LPG, naphtha, orthoxylene, refinery gases, styrene, vinyl chloride monomer. Products: acetone (50,000 mt/y), benzene (110,000 mt/y), butadiene (20,000 mt/y), cumene (140,000 mt/y), ethylene (230,000 mt/y), phthalic anhydride (20,000 mt/y), plasticizers (11,000 mt/y), polyester (15,000 mt/y), ld polyethylene (180,000 mt/y), polystyrene (35,000 mt/y), polypropylene (120,000 mt/y), polyvinyl chloride (80,000 mt/y), propylene (170,000 mt/y).

## FRANCE

**AMMONIAC DE GRAND QUEVILLY**
(77.5% CdF Chimie AZF, 22.5% Cofaz)

**Grand Quevilly** (near Rouen). Feed: natural gas. Product: ammonia (1,000 mt/d).

**AMMONIAC SARRO-LORRAIN**
(52% CdF Chimie AZF, 27% CSL, 15% Norsolor)

**Carling.** Feed: natural gas. Product: ammonia (330,000 mt/y).

**APPRYL**
(51% Atochem, 49% BP Chemicals)

**Gonfreville.** Product: polypropylene (150,000 mt/y).

**Lavera.** Product: polypropylene (200,000 mt/y).

**ARCO CHEMICAL**
**Fos-sur-Mer.** Products: MTBE (10,800 b/d), propylene glycols (80,000 mt/y), propylene oxide (165,000 mt/y), tertiary butyl alcohol (395,000 mt/y), polyols (110,000 mt/y).

**ATOCHEM**
**Balan (Ain).** Products: ld polyethylene (90,000 mt/y), lld polyethylene (35,000 mt/y), polyvinyl chloride (180,000 mt/y).
**Brignoud.** Product: polyvinyl chloride (115,000 mt/y).
**Chauny.** Feed: naphthalene, orthoxylene. Products: phthalic anhydride (75,000 mt/y), plasticizers (70,000 mt/y).
**Feyzin.** Feed: LPG, naphtha. Products: benzene (110,000 mt/y), butadiene (30,000 mt/y), ethylene (135,000 mt/y), propylene (110,000 mt/y), toluene (40,000 mt/y).
**Gonfreville l'Orcher.** Feed: LPG, naphtha. Products: benzene (150,000 mt/y), butadiene (60,000 mt/y), ethylene (470,000 mt/y), hd polyethylene (80,000 mt/y), ld + EVA polyethylene (160,000 mt/y), polystyrene (160,000 mt/y), propylene (230,000 mt/y), styrene (350,000 mt/y).
**La Chambre (Savoie).** Feed: acetone, ethanol, 2-butanol, isopropanol. Product: solvents (85,000 mt/y).
**Lacq (Snea plant).** Feed: ethane. Products: benzene (60,000 mt/y), ethylbenzene (55,000 mt/y), ethylene (75,000 mt/y), styrene (50,000 mt/y).
**Lavera.** Feed: LPG, naphtha. Products: butadiene (50,000 mt/y), chloromethanes (120,000 mt/y), ethylene (260,000 mt/y), propylene (185,000 mt/y), vinyl chloride (400,000 mt/y).
**Mont (near Lacq).** Feed: ammonia, ethylene, vinyl acetate. Product: ld polyethylene with EVA copolymers (75,000 mt/y).
**Notre Dame de Gravenchon (Seine Maritime).** Feed: n-butenes. Product: 2-butanol (50,000 mt/y).
**Port de Bouc, Fos.** Product: vinyl chloride (200,000 mt/y).
**Saint Auban.** Products: polyvinyl chloride (130,000 mt/y), solvents (160,000 mt/y).
**Saint Fons, Rhone.** Product: polyvinyl chloride (175,000 mt/y).

**AZOLACQ**
(50% Cofaz, 50% CdF Chimie AZF)
**Oissel.** Feed: ammonia, carbon dioxide. Product: urea (360 mt/d).

**BAYER ELASTOMÈRES**
**Lillebonne.** Feed: butadiene, styrene. Products: polybutadiene (55,000 mt/y), SBR (8,000 mt/y), SBR latex (24,000 mt/y).

**BORG WARNER**
**Villers Saint Sepulcre (Oise).** Product: ABS (50,000 mt/y).

**BP CHEMICALS LTD.**
**Wingles.** Products: polystyrene (110,000 mt/y), expandable polystyrene (45,000 mt/y).

**BP CHIMIE**
**Lavéra, Martigues.** Feed: GPL, naphtha. Products: benzene (85,000 mt/y), butadiene (50,000 mt/y), ethylene (250,000 mt/y), ethylene glycol (165,000 mt/y), ethylene oxide (150,000 mt/y), polyisobutylene (36,000 mt/y), polyethylene (140,000 mt/y), propylene (180,000 mt/y).

**CDF CHIMIE AZF**
(100% CdF Chimie)
**Mazingarbe.** Feed: coke oven gas, naphtha. Products: ammonia (220,000 mt/y).
**Toulouse.** Feed: natural gas. Products: ammonia (330,000 mt/y), urea (150,000 mt/y).

**CdF CHIMIE EP**
**Carling and Lillebonne.** Feed: benzols, gazole, naphtha. Products: benzene (330,000 mt/y), butadiene (130,000 mt/y), cyclohexane (65,000 mt/y), ethylbenzene (280,000 mt/y), ethylene (420,000 mt/y), ld polyethylene (210,000 mt/y), propylene (220,000 mt/y), styrene (220,000 mt/y).

**CDF CHIMIE RÉSINES**
(100% CdF Chimie)
**Drocourt.** Feed: benzene, butadiene, styrene. Products: maleic-phthalic anhydride (20,000 mt/y), polyester (50,000 mt/y).
**Saint Avold.** Feed: aromatics. Product: hydrocarbon resins (24,000 mt/y).
**Villers Saint Paul (Oise).** Feed: benzene. Products: maleic anhydride (12,000 mt/y).

**CIE. CHIMIQUE DE LA MEDITERRANEE SA**
(Shell 50%, BASF 50%)
**Berre l'Etang.** Feed: ethylene. Product: ld polyethylene (110,000 mt/y).

**CRD-TOTAL FRANCE**
**Gonfreville l'Orcher.** Feed: crude. Products: benzene (70,000 mt/y), polybutene (20,000 mt/y), polypropylene (40,000 mt/y),toluene (20,000 mt/y).

**CIE. DU POLYISOPRENE SYNTHETIQUE**
**Oudalle.** Feed: C-5's, isoprene. Products: isoprene-azeotrope (45,000 mt/y), polyisoprene (45,000 mt/y).

**COPENOR-Compagnie Petrochimique du Nord**
(60% CdF Chimie EP)
**Dunkirk.** Feed: naphtha, gazole, LPG. Products: butadiene (75,000 mt/y), ethylene (250-275,000 mt/y), ld polyethylene (275,000 mt/y), lld polyethylene (100,000 mt/y), propylene (120,000 mt/y).

**DEGUSSA**
**Ambès.** Feed: aromatic hydrocarbons, coal tar oil. Product: carbon black.

**HGD—Huiles, Goudrons et Dérivés**
(94% CdF Chimie)
**Mariénau.** Feed: coal tars. Product: naphthalene (20,000 mt/y).
**Vendin le Vieil.** Feed: coal tars. Product: naphthalene (25,000 mt/y).

**ICI LTD.**
**Balycourt.** Product: plasticizers (75,000 mt/y).

**NOROXO**
(100% CdF Chimie)
**Harnes (Pas-de-Calais).** Feed: olefins. Products: oxoalcohols (115,000 mt/y), oxoacids (20,000 mt/y).

**NORSK HYDRO AZOTE**
**Le Havre, Pardies, Rouen, Pierrefitte.** Feed: gas. Products: ammonia (730,000 mt/y), urea (190,000 mt/y).

**NORSOLOR**
(100% CdF Chimie)
**Saint Avold.** Feed: acetone, alcohols, ammonia, propylene. Products: acrylic acid (100,000 mt/y), acrylonitrile (90,000 mt/y), acrylic-esters (200,000 mt/y).

**ORGANICHIM.**
(100% CdF Chimie)
**Toulouse.** Product: formaldehyde (25,000 mt/y).
**Villers St. Paul.** Product: formaldehyde (50,000 mt/y).

**OXOCHIMIE.**
(50% Atochem, 50% BP Chimie)
**Lavera.** Product: oxoalcohols (175,000 mt/y).

**PEC-RHIN**
(50% CdF Chimie AZF, 50% BASF).
**Ottmarsheim.** Feed: natural gas. Product: ammonia (180,000 mt/y).

**PETROSYNTHESE SA**
(100% Chevron Chemical Co.)
**Gonfreville.** Feed: benzene, propylene. Product: alkylbenzene (100,000 mt/y).

**POLYSAR FRANCE SA.**
**Strasbourg.** Feed: acrylonitrile, benzene, butadiene, ethylene. Products: SBR latex, nitrile rubber (160,000 mt/y).

**RESINOPLAST**
(100% Atochem)
**Reims.** Product: polyvinyl chloride compounds (40,000 mt/y).
**Saint Fons.** Product: polyninyl chloride compounds (60,000 mt/y).

**RHONE POULENC**
**Pardies.** Feed: natural gas, methanol. Products: acetic acid (300,000 mt/y), vinyl acetate (160,000 mt/y).
**Pont de Claix.** Product: bisphenol A (60,000 mt/y).
**Roussillon.** Feed: acetic acid, benzene, propylene. Products: acetic anhydride (80,000 mt/y), acetone (60,000 mt/y), cumene (145,000 mt/y), phenol (100,000 mt/y).
**Saint-Fons (Belle-Etoile).** Feed: paraxylene. Product: dimethyl terephthalate (70,000 mt/y).

**SHELL CHIMIE**
**Berre l'Etang.** Feed: gas oil, LPG, naphtha. Products: benzene (60,000 mt/y), butadiene (80,000 mt/y), ethylene (420,000 mt/y), isopropanol (110,000 mt/y), ld polyethylene (110,000 mt/y), polybutadiene (50,000 mt/y), polypropylene (135,000 mt/y), polystyrene (55,000 mt/y), polyvinyl chloride (205,000 mt/y), propylene (210,000 mt/y), toluene (12,000 mt/y).

**SOCABU-SOCIETE DU CAOUTCHOUC BUTYL**
**Notre Dame de Gravenchon.** Feed: refinery products. Products: butyl rubber (52,000 mt/y), ethylene-propylene rubber (50,000 mt/y).

**SOCIÉTÉ ARTESIENNE DE VINYLE**
(DSM subsidiary)
**Mazingarbe.** Product: polyvinyl chloride (195,000 mt/y).

**SOCIÉTÉ CHIMIQUE DE DIEUZE**
(100% CdF Chimie EP)
**Dieuze.** Feed: styrene. Product: polystyrene (75,000 mt/y).
**Ribecourt.** Feed: styrene. Product: polystyrene (110,000 mt/y).

**SOCIÉTÉ DES ENGRAIS DE L'ILE DE FRANCE**
(50% CdF Chimie AZF, 50% Grande Paroisse)
**Nangis.** Feed: natural gas. Product: ammonia (300,000 mt/y).

**SOCIÉTÉ DU CHLORURE DE VINYLE DE FOS**
(60% Shell Chimie, 40% Atochem)
**Fos sur Mer (Bouches du Rhône).** Feed: chlorine, ethylene. Product: vinyl chloride (200,000 mt/y).

**SOCIÉTÉ DU POLYETHYLENE DE FOS**
(100% Shell)
**Fos sur Mer** (Bouches du Rhone). Feed: ethylene. Product: ld polyethylene (100,000 mt/y).

**SOCIÉTÉ FRANCAISE EXXON CHEMICAL**
**Notre Dame de Gravenchon.** Feed: refinery products. Products: butadiene (70,000 mt/y), ethylene (300,000 mt/y), propylene (220,000 mt/y), solvents (60,000 mt/y).

**SOCIÉTÉ FRANCAISE HOECHST**
**Cuise-LaMotte.** Feed: methanol. Product: formaldehyde (12,000 mt/y).
**Lillebonne.** Feed: ethylene, propylene. Product: acetaldehyde (96,000 mt/y), polypropylene (120,000 mt/y).

**SOCIÉTÉ NORMANDE DE L'AZOTE**
(56% Cofaz, 44% CdF Chimie AZF)
**Gonfreville.** Feed: naphtha, natural gas. Products: ammonia (330,000 mt/y), urea (250,000 mt/y).

**SODES—Société d'Ethanol de Synthèse**
(23.5% Atochem, 34% SFECI, 31% Beghin Say)
**Lillebonne.** Product: ethanol (120,000 mt/y), ether (10,000 mt/y).

### SOLVAY & CIE.

**Sarralbe.** Feed: ethylene, propylene. Products: hd polyethylene, polypropylene, Polyvinyl Chloride.

**Taveux.** Feed: ethylene. Products: polyvinyl chloride, vinyl chloride, vinylidene chloride, polyvinylidene chloride, vinylidene fluoride and polyvinylidene.

### UNITED CHEMICAL FRANCE

**Port Jerome.** Feed: aromatic oils. Product: carbon black (88,000 mt/y).

## GERMANY

### BASF AG

**Ludwigshafen.** Feed: fuel oil, naphtha, natural gas. Products: acetic acid (40,000 mt/y), acetylene (85,000 mt/y), acrylic acid (210,000 mt/y), ammonia (700,000 mt/y), butanols (220,000 mt/y), caprolactam (150,000 mt/y), ethylbenzene (350,000 mt/y), ethylene (450,000 mt/y) ethylene oxide (150,000 mt/y), formaldehyde (1,200,000 mt/y), melamine (40,000 mt/y), methanol (240,000 mt/y), higher oxoalcohols (100,000 mt/y), 2-ethylhexanol (150,000 mt/y), phthalic anhydride (90,000 mt/y), polyamide (worldwide—105,000 mt/y), ld polyethylene (18,000 mt/y), polyisobutylene (6,000 mt/y), polypropylene (10,000 mt/y), polystyrene (315,000 mt/y), polyvinyl chloride (150,000 mt/y), propanol (25,000 mt/y), propylene (240,000 mt/y), propylene glycol (40,000 mt/y), propylene oxide (75,000 mt/y), styrene (500,000 mt/y), urea (480,000 mt/y), vinyl chloride (100,000 mt/y), plasticizers (220,000 mt/y).

### BAYER AG

**Dormagen.** Products: acrylonitrile-butadiene-styrene (115,000 mt/y), polyamide (50,000 mt/y).

**Uerdingen.** Products: bisphenol A (707,000 mt/y), formaldehyde (95,000 mt/y), maleic anhydride (12,000 mt/y), phthalic anhydride (60,000 mt/y), SBR (45,000 mt/y).

### BP BENZIN UND PETROLEUM AG UND CALIFORNIA CHEMICAL GmbH oHG.

(owned jointly by Chevron Chemical Company and BP Benzin und Petroleum AG)

**Dinslaken.** Feed: reformate. Products: orthoxylene (24,000 mt/y), paraxylene (20,000 mt/y).

### CHEMISCHE WERKE SAARLOTHRINGEN

(100% CdF Chimie)

**Perl/Besch.** Feed: ammonia. Products: formaldehyde (44,000 mt/y), urea (200,000 mt/y), resins (12,000 mt/y).

### COLUMBIAN CARBON DEUTSCHLAND

**Hamburg.** Feed: oil. Product: aromatics mix (40-80,000 mt/y), carbon black (35,000 mt/y).

### CONDEA CHEMIE GmbH

(owned by Conoco Inc. and Deutsche Texaco AG)

**Brunsbüttel.** Feed: ethylene, hydrogen. Product: synthetic straight chain primary fatty alcohols (75,000 mt/y).

### DEGUSSA AG

**Bruchhausen.** Feed: methyl alcohol. Product: formaldehyde.

**Kalscheuren.** Feed: aromatic hydrocarbons, coal tar oil. Product: carbon black.

**Mainz-Mombach.** Feed: methyl alcohol. Product: formaldehyde.

### DEUTSCHE EXXON CHEMICAL GmbH

**Cologne.** Feed: raffinate 1, (spent butenes). Products: butylenes (35,000 mt/y), polyisobutylene (45,000 mt/y).

### DEUTSCHE MARATHON PETROLEUM GmbH

(subsidiary of OEMV AG, Vienna, Austria)

**Burghausen, Bavaria.** Feed: refinery streams. Products: benzene (120,000 mt/y), butadiene-$C_4$ cut (90,000 mt/y), ethylene (280,000 mt/y), propylene (130,000 mt/y).

### DEUTSCHE SHELL AG

**Cologne-Godorf.** Feed: pyrolysis gasoline, reformate. Products: benzene (400,000 mt/y), orthoxylene (100,000 mt/y), paraxylene (75,000 mt/y), toluene (220,000 mt/y).

### DEUTSCHE SOLVAY-WERKE GmbH

**Rheinberg.** Feed: ethylene. Products: polyvinyl chloride, vinyl chloride.

### RWE—DEA AKTIENGESELLSCHAFT FÜR MINERALOEL UND CHEMIE

**Heide.** Feed: refinery products. Products: benzene (70,000 mt/y), butylenes (28,000 mt/y), ethylbenzene (11,000 mt/y), ethylene (80,000 mt/y), MTBE (12,500 mt/y), orthoxylene (15,000 mt/y), parametaxylene (38,000 mt/y), propylene (55,000 mt/y), toluene (130,000 mt/y).

**Meerbeck und Duisburg.** Feed: refinery products and chemicals. Products: acetone (36,000 mt/y), alkylbenzene (25,000 mt/y), alkyl chlorides (2,000 mt/y), isopropanol (140,000 mt/y), maleic anhydride (7,500 mt/y), plasticizers (24,000 mt/y), resins (36,000 mt/y), ketones (99,000 mt/y).

### DOW CHEMICAL

**Rheinmuenster.** Products: SB-latex, resins.

**Stade.** Products: bisphenol, propylene oxide, propylene glycol, resins, solvents.

### EC ERDOLCHEMIE GmbH

(owned by Bayer AG and Deutsche BP AG)

**Worringen, Cologne.** Feed: naphtha. Products: acetylene (7,000 mt/y), acrylonitrile (280,000 mt/y), ammonia (330,000 mt/y), benzene (200,000 mt/y), butadiene (245,000 mt/y), butylenes (90,000 mt/y), ethanol (60,000 mt/y), ethylene (740,000 mt/y), ethylene glycol (150,000 mt/y), ethylene oxide (175,000 mt/y), propylene (520,000 mt/y), propylene glycol (40,000 mt/y), propylene oxide (150,000 mt/y), toluene (100,000 mt/y), polyethylene (300,000 mt/y).

### EVC

(50% ICI, 50% Enichem)

**Waldshut.** Product: polyvinyl chloride (25,000 mt/y).

**Wilhelmshaven.** Product: vinyl chloride (320,000 mt/y), ethylene dichloride (300,000 mt/y).

### HOECHST AG

**Frankfurt.** Feed: ethylene, propylene, natural gas. Products: acetaldehyde (130,000 mt/y), acetic acid (160,000 mt/y), hd polyethylene (149,000 mt/y), polyvinyl alcohol (25,000 mt/y), vinyl acetate (150,000 mt/y).

**Gendorf.** Feed: ethylene. Products: ethylene glycol (100,000 mt/y), ethylene oxide (120,000 mt/y), polyvinyl chloride (155,000 mt/y), vinyl chloride (160,000 mt/y).

**Gersthofen.** Feed: p-xylene, methanol. Product: dimethyl terephthalate (135,000 mt/y).

**Kelsterbach.** Feed: olefins. Products: ethylene glycol-ethylene oxide (50,000 mt/y), polypropylene (130,000 mt/y).

**Knapsack.** Feed: olefins. Products: acetaldehyde (150,000 mt/y), acetic acid (70,000 mt/y), acetic anhydride (100,000 mt/y), polypropylene (90,000 mt/y), hd polyethylene (106,000 mt/y), polyvinyl chloride (105,000 mt/y), vinyl chloride (105,000 mt/y).

**Muenchsmuenster.** Feed: ammonia, ethylene, propylene. Products: acrylonitrile (90,000 mt/y), hd polyethylene (75,000 mt/y).

**Oberhausen, Holten.** Feed: olefins. Products: hd polyethylene (80,000 mt/y), oxoalcohols (335,000 mt/y).

**Offenbach.** Feed: p-xylene, methanol. Product: dimethyl terephthalate (95,000 mt/y).

### HÜLS

**Marl.** Products: acetaldehyde (80,000 mt/y), acetic acid (40,000 mt/y), acetylene (120,000 mt/y), alkylbenzene (80,000 mt/y), butanol-n-isobutanol (130,000 mt/y), cumene (140,000 mt/y), dimethyl terephthalate (410,000 mt/y), ethanol (130,000 mt/y), ethylbenzene (300,000 mt/y), ethylchloride (30,000 mt/y), ethylene (50,000 mt/y), ethylene dichloride (250,000 mt/y), ethylene glycol (90,000 mt/y), ethylene oxide (150,000 mt/y), isopropanol (75,000 mt/y), maleic anhydride (35,000 mt/y), oxoalcohols-octanol (200,000 mt/y), phthalic anhydride (150,000 mt/y), polyamide-12 (14,000 mt/y), polyester (34,000 mt/y), polyethylene (130,000 mt/y), polypropylene (120,000 mt/y), polystyrene + EPS(205,000 mt/y), vinyl chloride (350,000 mt/y), polyvinyl chloride (380,000 mt/y), propylene glycol (22,000 mt/y), propylene oxide (27,000 mt/y), styrene (300,000 mt/y).

### HÜLS TROISDORF AG

**Lulsdorf.** Products: dimethyl terephthalate (150,000 mt/y), ethylene dichloride (85,000 mt/y).

**Steyerberg.** Product: dimethyl terephthalate (180,000 mt/y).

### NORSK HYDRO RUHR

**Brunsbüttel.** Feed: heavy fuel oil. Products: ammonia (585,000 mt/y), urea (330,000 mt/y).

### PHENOLCHEMIE GmbH

**Gladbeck.** Feed: cumene. Products: acetone (250,000 mt/y), phenol (400,000 mt/y).

### PHILLIPS PETROLEUM INTERNATIONAL GmbH

**Hannover.** Product: carbon black (50,000 mt/y).

### RHEINISCHE OLEFINWERKE GmbH

(Shell 50%, BASF 50%)

**Wesseling.** Feed: gas oil, naphtha. Products: butadiene (150,000 mt/y), ethylene (650,000 mt/y), ethylbenzene (430,000 mt/y), ld polyethylene (400,000 mt/y), hd polyethylene (215,000 mt/y), polyisobutylene (8,000 mt/y), polypropylene (120,000 mt/y), propylene (310,000 mt/y), styrene (420,000 mt/y), SB rubber (30,000 mt/y), thermoplastic rubber (45,000 mt/y).

### RUHR OEL GMBH

(50% Veba Oel AG, 50% Petróleos de Venezuela SA)

**Gelsenkirchen.** Feed: gas oil, naphtha, distil resid. Products: ammonia (400,000 mt/y), benzene (296,000 mt/y), cumene (330,000 mt/y), cyclohexane (100,000 mt/y), ethylene (440,000 mt/y), methanol (240,000 mt/y), orthoxylene (110,000 mt/y), n-paraffins (96,000 m/ty), paraxylene (120,000 mt/y), propylene (265,000 mt/y), toluene (90,000 mt/y), phthalic anhydride (63,000 mt/y).

**Münchsmünster.** Feed: LPG, naphtha. Products: ethylene (200,000 m/ty), propylene (150,000 mt/y).

### RWE—DEA AKTIENGESELLSCHAFT FÜR MINERALOEL UND CHEMIE

**Wesseling.** Feed: LPG, natural gas, pyrolysis gasoline, reformate, resid, refinery gas, xylene mix. Products: benzene (120,000 mt/y), ethylene (440,000 mt/y), methanol (400,000 mt/y), orthoxylene (32,000 mt/y), paraxylene (72,000 mt/y), propylene (260,000 mt/y), toluene (80,000 mt/y), xylene mix (62,000 mt/y).

### WACKER-CHEMIE GmbH

**Burghausen/Obb.** Feed: ethylene. Products: acetaldehyde, acetic acid, acetic anhydride, ethylene dichloride, plasticizers, polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, vinyl acetate, vinyl chloride, solvents.

### WINTERSHALL AG

**Ibbenburen.** Feed: benzene, chlorine, n-paraffins. Product: alkylbenzene (36,000 mt/y).

**Lingen-Ems.** Feed: reformate, benzene-hydrogen, kerosine. Products: benzene (72,000 mt/y), cyclohexane (100,000 mt/y), normal paraffins (30,000 mt/y).

**Mannheim.** Feed: pyrolysis-gasoline, reformate. Product: benzene (270,000 mt/y).

## GREECE

### DOW CHEMICAL

**Lavrion.** Product: polystyrene.

### EKO CHEMICALS CO. AE

**Thessaloniki.** Feed: naphtha, refinery cuts, vinyl chloride. Products: ammonia (120,000 mt/y), ethylene (15,000 mt/y), ethylene dichloride (35,000 mt/y), normal paraffins (45,000 mt/y), polyvinyl chloride (70,000 mt/y).

### HADJILUCAS SA

**Halkis.** Feed: methanol. Product: formaldehyde (20,000 mt/y).

## HUNGARY

### BORSODI VEGYI KOMBINÁT

**Kazincbarcika.** Feed: ethylene, natural gas. Products: ammonia (220,000 mt/y), ethylene dichloride (170,000 mt/y), polyamide (1,300 mt/y), polyvinyl chloride (190,000 mt/y), urea (120,000 mt/y), vinyl chloride (170,000 mt/y).

### CHEMOKOMPLEX

**Kazincbarcika.** Product: vinyl chloride monomer (185,000 mt/y).

### HUNGARIAN OIL AND GAS TRUST

**Százhalombatta.** Feed: pyrolysis gasoline, reformate, vac gas oil (FCC unit). Products: benzene (110,000 mt/y), maleic anhydride (10,000 mt/y), orthoxylene (52,000 mt/y), propylene (42,000 mt/y), toluene (110,000 mt/y), xylene mix (48,000 mt/y).

### TISZAI VEGYI KOMBINÁT

**Leninváros.** Feed: naphtha, natural gas. Products: ammonia (265,000 mt/y), butadiene (80,000), ethylene (250,000 mt/y), ld polyethylene (210,000 mt/y), polypropylene (105,000 mt/y), propylene (125,000 mt/y).

## INDIA

### ADARSH CHEMICALS & FERTILIZERS LTD.

**Udhna, Gujarat.** Feed: benzene. Product: maleic anhydride (7,000 mt/y).

### AHMEDABAD MANUFACTURING & CALICO PRINTING CO. LTD.

**Baroda.** Feed: dimethyl terephthalate, ethylene glycol. Product: polyester (7,968 mt/y).

### BAKELITE HYLAM LTD.

**Nacharam, Hyderabad.** Feed: methanol. Product: formaldehyde (3,000 mt/y).

**Sanathnagar, Hyderabad**. Feed: phenol, formaldehyde, styrene, maleic-phthalic anhydride, isophthalic acid, propylene glycol. Products: phenolic resins (2,000 mt/y), polyester resins (1,800 mt/y).

### BOMBAY DYEING AND MANUFACTURING CO. LTD.

**Bombay.** Feed: parazylene. Product: dimethyl terephthalate (60,000 mt/y).

### BONGAIGAON REFINERY & PETROCHEMICALS LTD.

**Dhaligaon, Assam.** Feed: reformer feed naphtha. Products: dimethyl terephthalate (45,000 mt/y), orthoxylene (6,000 mt/y), paraxylene (29,000 mt/y), polyester staple fiber (30,000 mt/y).

### CHEMICALS & PLASTICS INDIA LTD.

**Krishnagiri.** Feed: molasses. Product: ethanol (12,000 mt/y).

**Metturdam.** Feed: chlorine, ethanol. Products: ethylene (18,700 mt/y), ethylene dichloride (37,000 mt/y), polyvinyl chloride (21,300 mt/y), vinyl chloride (22,000 mt/y).

### CHEMIDYE MANUFACTURING CO. LTD.

**Tamil Nadu.** Feed: phthalic anhydride. Products: solvents (5,000 mt/y), plasticizers (5,000 mt/y).

### COROMANDEL FERTILIZERS LTD.

(International Minerals & Chemicals Corp., Chevron Chemical Corp., E.I.D. Parry (India) Ltd.)

**Visakhapatnam, Andhra Pradesh.** Feed: naphtha. Products: ammonia (114,240 mt/y), urea (125,600 mt/y).

### FERTILIZER CORP. OF INDIA LTD.

**Gorakhpur, Uttar Pradesh.** Feed: naphtha. Products: ammonia (171,000 mt/y), urea (285,000 mt/y).

**Ramagundam, Andhra Pradesh.** Feed: coal. Products: ammonia (297,000 mt/y), urea (495,000 mt/y).

**Sindri, Bihar.** Feed: fuel oil. Products: ammonia (297,000 mt/y), urea (330,000 mt/y).

**Talchar, Orissa.** Feed: coal. Products: ammonia (297,000 mt/y), urea (495,000 mt/y).

### FERTILIZERS AND CHEMICALS, TRAVANCORE LTD. (FACT) and FACT ENGINEERING AND DESIGN ORGANIZATION (FEDO)

**Ambalamedu (near Cochin), Kerala.** Feed: naphtha. Products: ammonia (198,000 mt/y), urea (330,000 mt/y).

**Udyogamandal (near Cochin), Kerala.** Feed: naphtha. Product: ammonia (112,200 mt/y).

### GARWARE NYLONS LTD.

**Pimpri, Poona.** Feed: caprolactam, dimethyl terephthalate, ethylene glycol. Products: nylon 6 (4,830 mt/y), polyamide (360 mt/y), polyester (1,576 mt/y).

### GUJARAT NARMADA VALLEY FERTILIZERS CO. LTD.

**Narmadanagar, Bharuch.** Feed: fuel oil. Products: ammonia (1,350 mt/d), methanol (60 mt/d), urea (1,800 mt/d).

### GUJARAT STATE FERTILIZERS CO. LTD.

**Fertilizernagar (near Baroda).** Feed: benzene,naphtha, natural gas. Products: ammonia (348,000 mt/y), caprolactam (20,000 mt/y), melamine (5,000 mt/y), nylons (4,000 mt/y), urea (367,200 mt/y).

### HERDILLIA CHEMICALS LTD.

**Thane, Bombay.** Feed: benzene, orthoxylene, propylene, 2-ethyl hexanol. Products: acetone (12,000 mt/y), cumene (29,800 mt/y), phenol (20,000 mt/y), phtnaiic anhydride (8,600 mt/y), plasticizers (8,500 mt/y), solvents (2,400 mt/y), styrene (900 mt/y).

### HINDUSTAN FERTILIZER CORP. LTD.

**Barauni (Bihar).** Feed: naphtha. Products: ammonia (600 mt/d), urea (1,000 mt/d).

**Durgapur.** Feed: naphtha. Products: ammonia (600 mt/d), urea (1,000 mt/d).

**Namrup (Assam).** Feed: natural gas. Products: ammonia (1,400 mt/d), urea (2,167 mt/d).

### HINDUSTAN ORGANIC CHEMICALS LTD.

(Government of India enterprise).

**Rasayani and Cochin.** Products: acetic acid (1,330 mt/y), acetic anhydride (2,000 mt/y), acetone (24,640 mt/y), formaldehyde (15,000 mt/y), phenol (40,000 mt/y), propylene (7,000 mt/y).

### IEL LTD.

**Kanpur, Uttar Pradesh.** Feed: naphtha. Products: ammonia (411,000 mt/y), urea (675,000 mt/y).

### ILAC LTD.

(100% Ahmedabad Mfg. & Calico Printing Co. Ltd.)

**Bombay.** Feed: acetylene. Products: polyvinyl chloride (25,000 mt/y), vinyl chloride (6,500 mt/y).

### INDIAN FARMERS FERTILIZER COOPERATIVE LTD.

**Aonla, Bareilly.** Feed: natural gas. Products: ammonia (445,500 mt/y), urea (726,000 mt/y).

**Kalol, Gujarat.** Feed: natural gas. Products: ammonia (300,300 mt/y), urea (396,000 mt/y).

**Phulpur, Uttar Pradesh.** Feed: ammonia. Products: ammonia (297,000 mt/y), urea (495,000 mt/y).

### INDIAN OIL CORP. LTD.

**Gujarat, Baroda.** Feed: reformate. Products: benzene (50,000 mt/y), toluene (20,000 mt/y).

### INDIAN PETROCHEMICALS CORP. LTD.

**Baroda, Gujarat.** Feed: naphtha. Products: acrylonitrile (30,000 mt/y), alkylbenzene (43,500 mt/y), aromatics mix (10,000 mt/y), benzene (23,600 mt/y), butadiene (22,000 mt/y), carbon black feedstock (17,900 mt/y), dimethyl terephthalate (30,000 mt/y), ethylene (130,000 mt/y), ethylene dichloride (100,000 mt/y), ethylene glycol (13,900 mt/y), ethylene oxide (5,000 mt/y), normal paraffins (25,000 mt/y), xylene mix (2,900 mt/y), paraxylene (48,600 mt/y), polybutadiene rubber (20,000 mt/y), ld polyethylene (80,000 mt/y), polypropylene (30,000 mt/y), polypropylene (Copol) (25,000 mt/y), polyvinyl chloride (55,000 mt/y), propylene (81,300 mt/y), pyrolysis gasoline (63,900 mt/y), vinyl chloride (57,300 m/ty).

### MADRAS FERTILIZERS LTD.

**Manali.** Feed: sr naphtha. Products: ammonia (247,500 mt/y), urea (292,000 mt/y).

### McDOWELL & CO. LTD. (Polymers Division)

**Visakhapatnam.** Feed: benzene, molasses. Products: ethylene (3,300 mt/y), styrene (15,000 mt/y), polystyrene (14,500 mt/y).

### MYSORE PETROCHEMCIALS LTD.

**Raichur, Karnataka.** Feed: orthoxylene. Product: phthalic anhydride (10,230 mt/y).

### NAGARJUNA FERTILIZERS AND CHEMICALS LTD.

**Kakinada.** Feed: natural gas. Products: ammonia (900 mt/d), toluene (1,500 mt/d).

### NATIONAL FERTILIZERS LTD.

**Bhatinda, Punjab.** Feed: fuel oil, low sulfur heavy stock. Products: ammonia (297,000 mt/y), urea (511,500 mt/y).

**Naya Nangal, Punjab.** Feed: fuel oil, low sulfur heavy stock. Products: ammonia (297,000 mt/y), methanol (16,500 mt/y), urea (330,000 mt/y).

**Panipat, Haryana.** Feed: fuel oil, low sulfur heavy stock. Products: ammonia (297,000 mt/y), urea (511,500 mt/y).

### NATIONAL ORGANIC CHEMICAL INDUSTRIES LTD.

**Thane.** Feed: naphtha. Products: acetone (14,000 mt/y), benzene (17,000 mt/y), butadiene (7,200 mt/y), butanol (6,000 mt/y), ethylene (63,000 mt/y), ethylene dichloride (50,000 mt/y), ethylene glycol (11,000 mt/y), ethylene oxide (14,000 mt/y), isopropanol (21,000 mt/y), methyl isobutyl ketone (4,000 mt/y), oxoalcohols (10,000 mt/y), polyvinyl chloride (21,500 mt/y), propylene (37,000 mt/y), vinyl chloride (30,000 mt/y).

### PHILLIPS CARBON BLACK LTD.

(owned by Phillips Petroleum, Duncan Bros. Co. Ltd., and public)

**Durgapur, West Bengal.** Feed: heavy oil. Product: carbon black (50,000 mt/y).

### POLYCHEM LTD.

**Baroda.** Feed: acrylonitrile, butadiene, styrene. Product: ABS (5,000 mt/y).

**Bombay**. Feed: alcohol, benzene, ethylene. Products: ethylbenzene (20,000 mt/y), ethylene (2,000 mt/y), polystyrene (16,000 mt/y), styrene (17,500 mt/y), toulene (800 mt/y).

**Nira (Maharashtra).** Feed: acetic acid, alcohol. ethanol, molasses, oxygen. Products: ethanol (10,000 mt/y), vinyl acetate (10,000 mt/y), polyvinyl alcohol (16,000 mt/y).

### POLYOLEFINS INDUSTRIES LTD. (PIL).

**Thane, Maharashtra.** Feed: ethylene. Product: hd polyethylene (50,000 mt/y).

### RASHTRIYA CHEMICALS & FERTILIZERS LTD.

**Chembur, Bombay.** Feed: associated gas, naphtha. Products: ammonia (402,600 mt/y), methanol (36,000 mt/y), urea (429,000 mt/y).

**Thal, Alibag.** Feed: associated gas. Products: ammonia (891,000 mt/y), urea (1,485,000 mt/y).

### SHRI AMBUJA PETROCHEMICALS LTD.

**Patancheru, Medak District.** Feed: orthoxylene. Product: phthalic anhydride (10,000 mt/y).

### SHRIRAM FERTILIZERS AND CHEMICALS

**Shriram Nagar, Kota.** Feed: naphtha, acetylene. Products: ammonia (200,000 mt/y), polyvinyl chloride (33,000 mt/y), urea (330,000 mt/y).

**SOUTHERN PETROCHEMICAL INDUSTRIES CORP. LTD.**
**Tuticorin, Tamil Nadu.** Feed: naphtha. Products: ammonia (352,000 mt/y), urea (512,000 mt/y).

**SYNTHETICS AND CHEMICALS LTD.**
(with Kilachand Devchand & Co. and Firestone Tire & Rubber Co.)
**Bareilly, Uttar Pradesh.** Feed: alcohol, benzene, petrobutadiene. Products: styrene (9,000 mt/y), SBR (33,000 mt/y).

**THIRUMALAI CHEMICALS LTD.**
**Ranipet, Tamil Nadu.** Feed: orthoxylene. Products: maleic anhydride (11,000 mt/y), phthalic anhydride (30,000 mt/y), unsaturated polyester (4,000 mt/y), plasticizers (6,000 mt/y).

**UNITED CARBON INDIA LTD.**
**Thane.** Feed: ethylene residues, phenol extracts, coal tar. Product: carbon black (40,000 mt/y).

**ZUARI AGRO CHEMICALS LTD.**
(Birla Gwalior Pvt. Ltd. and public interests)
**Zuarinagar.** Feed: naphtha. Products: ammonia (220,000 mt/y), urea (340,000 mt/y).

## INDONESIA

**PERTAMINA**
**(state oil company)**
**Bunyu, East Kalimantan.** Feed: natural gas. Product: methanol (330,000 mt/y).
**Plaju, South Sumatra.** Feed: paraxylene, propylene. Products: polypropylene (10,000 mt/y), terephthalic acid (150,000 mt/y).

**PERUM PETROKIMIA GRESIK.**
**Gresik, Surabaya.** Feed: fuel oil. Products: ammonia (3,600 mt/y), urea (45,000 mt/y).

**P.T. GEMA POLYTAMA KIMIA.**
**Anyer, West Java.** Product: polyols (27,500 mt/y).
**P.T. PUSRI**
**Palembang, South Sumatra.** Feed: natural gas. Product: urea (480,000 mt/y).

**P.T. PUPUK KUJANG**
**Cikampek, Java.** Feed: natural gas. Products: ammonia (330,000 mt/y), urea (570,000 mt/y).

## IRELAND

**IRISH FERTILIZER INDUSTRIES LTD.**
**Dublin.** Products: ammonia (435,000 mt/y), urea (330,000 mt/y), calcium ammonium nitrate.

## ISRAEL

**ELECTROCHEMICAL INDUSTRIES (FRUTAROM) LTD.**
**Near Ako.** Feed: ethylene. Products: ethylene dichloride (160,000 mt/y), polyvinyl chloride (90,000 mt/y), vinyl chloride (100,000 mt/y).

**FERTILIZERS & CHEMICALS LTD.**
**Haifa.** Feed: LP-gas, naphtha, Bunker C. Products: ammonia (80,000 mt/y), urea (40,000 mt/y).

**GADOT PETROCHEMICAL INDUSTRIES LTD.**
**Haifa Bay.** Feed: reformate, pyrolysis gasoline, aromatic streams. Products: aromatics mix (150,000 mt/y), benzene (40,000 mt/y), normal paraffins (40,000 mt/y), orthoxylene (18,000 mt/y), paraxylene (22,000 mt/y), phthalic anhydride (20,000 mt/y), toluene (50,000 mt/y), xylene mix (60,000 mt/y).

**ISRAEL PETROCHEMICAL ENTERPRISES LTD.**
**Haifa.** Feed: ethylene, styrene. Products: ld polyethylene (95,000 mt/y), polystyrene (16,000 mt/y).

## ITALY

**AGRIMONT SpA**
(Montedison Group)
**Ferrara.** Feed: natural gas. Products: ammonia (490,000 mt/y), urea (550,000 mt/y).
**Porto Marghera.** Feed: natural gas. Products: ammonia (175,000 mt/y), urea (180,000 mt/y).
**Priolo.** Feed: natural gas. Products: ammonia (330,000 mt/y), urea (200,000 mt/y).
**San Giuseppe di Cairo.** Feed: natural gas. Products: ammonia (170,000 mt/y), urea (200,000 mt/y).

**ALUSUISSE ITALIA SpA**
**Arezzo.** Products: plasticizers (75,000 mt/y), polyester resins (50,000 mt/y), phthalic anhydride (25,000 mt/y).
**Bergamo.** Products: maleic anhydride (38,000 mt/y), phthalic anhydride (80,000 mt/y).

**ASHLAND CHEMICAL ITALIANA SpA**
**Milan.** Products: acrylics (1,000 mt/y), alkyds (8,000 mt/y).

**AUSIND SpA**
(Montedison Group)
**Castellanza.** Feed: natural gas. Products: formaldehyde (300,000 mt/y), melamine (26,000 mt/y), methanol (120,000 mt/y), urea (100,000 mt/y).

**CABOT ITALIANA SpA**
(subsidiary of Cabot Corp., Waltham, Mass.)
**Ravenna.** Feed: petroleum fractions, aromatic tar. Product: carbon black (75,000 mt/y).

**CHIMICA DEL FRIULI**
(Snia Viscosa group)
**Torviscosa (Udine).** Product: caprolactam (20,000 mt/y).

**CHIMICA DEL TIRSO**
(50% EniChem, 50% Montefibre)
**Ottana (Sardinia).** Feed: paraxylene. Product: terephthalic acid (80,000 mt/y).

**CHIMICA DI COLLEFERRO SpA**
(Snia Viscosa group)
**Colleferro.** Product: polyester (40,000 mt/y).

**COLUMBIAN CARBON EUROPA SpA**
**Trecate.** Feed: heavy aromatic hydrocarbons. Product: furnace carbon black (50,000 mt/y).

**DISTILLERIE ITALIANE**
(Alusuisse Italia SpA)
**San Giovanni Valdarno (Arezzo).** Products: phthalic anhydride (25,000 mt/y), polyester (40,000 mt/y), plasticizers (75,000 mt/y).

**DOW ITALIA SpA**
**Livorno.** Products: ABS, polystyrene, SB-latex.

**DUTRAL S.r.l.**
(Enimont Group)
**Ferrara.** Product: EPR (60,000 mt/y).

**ENICHEM**
**Gela.** Feed: naphtha, natural gas. Products: acrylonitrile (90,000 mt/y), ammonia (220,000 mt/y), aromatics (150,000 mt/y), benzene (80,000 mt/y), butadiene (40,000 mt/y), ethylene (310,000 mt/y), ethylene dichloride (125,000 mt/y), ethylene glycol (46,000 mt/y), ethylene oxide (40,000 mt/y), ld polyethylene (90,000 mt/y), hd polyethylene (40,000 mt/y), polypropylene (50,000 mt/y), propylene (160,000 mt/y), toluene (90,000 mt/y), urea (200,000 mt/y), xylene mix (80,000 mt/y).
**Manfredonia.** Feed: natural gas. Products: ammonia (360,000 mt/y), urea (630,000 mt/y).
**Pisticci.** Feed: natural gas. Products: acrylic esters (7,000 mt/y), methanol (65,000 mt/y).
**Ragusa.** Feed: ethylene. Product: ld polyethylene (140,000 mt/y).
**Ravenna.** Feed: natural gas. Products: acetic acid (30,000 mt/y), acetylene (60,000 mt/y), ammonia (310,000 mt/y), butadiene (100,000 mt/y), isoprene (30,000 mt/y), polybutadiene (45,000 mt/y), polyisoprene (30,000 mt/y), polyvinyl acetate (25,000 mt/y), styrene (41,000 mt/y), urea (70,000 mt/y), vinyl acetate (30,000 mt/y), ABS (40,000 mt/y), SBR (150,000 mt/y), SBR latex (30,000 mt/y), nitrile (8,000 mt/y), solvents (100,000 mt/y).

**FAR—Fabrica Adesivi Resine**
**Filago, Bergamo District.** Products: formaldehyde (100,000 mt/y), acrylics (20,000 mt/y), polyvinyl acetate (25,000 mt/y).

**FTALITAL**
(Alusuisse Italia SpA)
**Scanzorosciate (Bergamo).** Feed: benzene, butane, naphthalene, orthoxylene. Products: maleic anhydride (38,000 mt/y), phthalic anhydride (80,000 mt/y).

**ICAM**
(100% EniChem)
**Priolo.** Feed: naphtha, gas oil. Products: ethylene (600,000 mt/y), propylene.

**HIMONT ITALIA**
**Brindisi.** Feed: propylene. Product: polypropylene (150,000 mt/y).
**Ferrara.** Feed: propylene. Product: polypropylene (120,000 mt/y).
**Terni.** Feed: propylene. Product: polypropylene (180,000).

**MOBIL CHIMICA ITALIANA**
**Naples.** Feed: light naphtha, hp reformate. Products: benzene (150,000 mt/y), cyclohexane (55,000 mt/y), orthoxylene (55,000 mt/y), paraxylene (80,000 mt/y), xylene mix (35,000 mt/y).

**MONTEDIPE**
(Montedison Group)
**Ferrara.** Product: polyester (6,500 mt/y).
**Mantova.** Products: acetone (140,000 mt/y), ethylbenzene (350,000 mt/y), ethylene dichloride (200,000 mt/y), maleic anhydride (11,000 mt/y), phenol (230,000 mt/y), polystyrene (270,000 mt/y), styrene (350,000 mt/y).
**Porto Marghera.** Products: acetic acid (65,000 mt/y), acetylene (40,000 mt/y), caprolactam (100,000 mt/y), ethylene (350,000 mt/y), propylene (180,000 mt/y), vinyl acetate (55,000 mt/y).
**Priolo.** Products: acetaldehyde (140,000 mt/y), ethylene dichloride (190,000 mt/y), ethylene oxide (15,000 mt/y), propylene glycol (13,000 mt/y), propylene oxide (40,000 mt/y).
**Villadossola.** Products: acrylics (11,000 mt/y), polyvinyl alcohol (2,000 mt/y), polyvinyl acetate (64,000 mt/y), polyvinyl acetate-ethylene (25,000 mt/y).

**SARAS CHIMICA**
(60% EniChem, 20% Saras, 20% Montedison)
**Sarroch (Sardinia).** Feed: refinery feedstock. Products: cumene (200,000 mt/y), ethylbenzene (40,000 mt/y), n-paraffins (160,000 mt/y), orthoxylene (80,000 mt/y), paraxylene (80,000 mt/y).

**SARPOM**
**Trecate (Novara).** Feed: intermediate and heavy virgin naphtha. Products: aromatics mix (25,000 mt/y), xylene mix (12,000 mt/y).

**SELM-Societa Energia Montedison**
(Montedison Group)
**Priolo.** Feed: naphtha, pyrolysis gasoline, propylene. Products: benzene (350,000 mt/y), cumene (270,000 mt/y), ethylbenzene (70,000 mt/y), orthoxylene (75,000 mt/y), paraxylene (130,000 mt/y), toluene (200,000 mt/y).

**SOCIETA CHIMICA DAUNA**
(50% EniChem, 50% Snia Viscosa)
**Manfredonia, Foggia.** Feed: toluene. Product: caprolactam (80,000 t/y).

**SOLVAY & CIE. SA**
**Ferrara.** Feed: vinyl chloride monomer. Products: polyvinyl chloride.
**Rosignano.** Feed: ethylene. Product: hd polyethylene.

**TECNOPOLIMERI SpA**
(Snia Viscosa group)
**Ceriano Laghetto (Milan).** Feed: caprolactam, PA66. Product: polyamide (27,000 mt/y).

**TERNI INDUSTRIE CHIMICHE SpA**

**Nera Montoro (Terni).** Feed: natural gas. Products: ammonia (120,000 mt/y), urea (100.000 mt/y).

**VEDRIL**
(Montedison Group)

**Rho.** Feed: ach. Product: acrylics (65,000 mt/y).

## JAPAN

**ASAHI CHEMICAL INDUSTRY CO. LTD.**

**Kawasaki.** Products: acrylic esters (20,000 mt/y), acrylonitrile (89,760 mt/y), acrylics (26,950 mt/y), polystyrene (55,200 mt/y), styrene (65,000 mt/y), BR-SBR rubber (129,000 mt/y).

**Mizushima.** Products: acrylonitrile (128,700 mt/y), ammonia (264,000 mt/y), hd polyethylene (82,000 mt/y), ld polyethylene (96,000 mt/y), polystyrene (145,000 mt/y), styrene (330,000 mt/y), ABS (48,000 mt/y), resins (25,000 mt/y), SB latex (14,000 mt/y).

**Nobeoka.** Product: nylon 66 (15,000 mt/y).

**ASAHI GLASS CO. LTD.**

**Chiba.** Feed: chlorine, natural gas, propylene. Products: ammonia (46,000 mt/y), propylene glycol (14,000 mt/y), propylene oxide (26,000 mt/y).

**Kashima.** Feed: chlorine, propylene. Products: propylene glycol (26,000 mt/y), propylene oxide (60,000 mt/y).

**ASIA OIL CO. LTD.**

**Yokohama.** Feed: heavy reformate. Product: benzene (100,000 mt/y).

**CHIBA BUTADIENE INDUSTRY CO. LTD.**

**Goi-minamikaigan, Chiba.** Feed: $C_4$. Product: butadiene (75,000 mt/y).

**CHIBA EDC CO. LTD.**

**Chiba.** Feed: chlorine, ethylene. Product: ethylene dichloride (74,000 mt/y).

**CHIBA VCM CO. LTD.**

**Chiba.** Feed: ethylene, ethylene dichloride. Product: vinyl chloride (160,000 mt/y).

**CHISSO CORP.**

**Minamata and Mizushima.** Feed: ethylene, vinyl chloride monomer. Products: polyvinyl chloride (96,000 mt/y), butanol (25,000 mt/y), butyraldehyde (100,000 mt/y).

**CHISSO PETROCHEMICAL CORP.**

**Goi.** Feed: ethylene, propylene. Products: oxoalcohols (100,000 mt/y), hd polyethylene (58,000 mt/y), polypropylene (213,000 mt/y), polyvinyl chloride (64,000 mt/y), solvents (44,000 mt/y), plasticizers (80,000 mt/y).

**COSMO MATSUYAMA OIL CO. LTD.**

**Ohkaga.** Feed: naphtha. Products: aromatics (119,300 mt/y), benzene (7,500 mt/y), toluene (21,700 mt/y), xylene mix (30,660 mt/y),.

**DAICEL CHEMICAL INDUSTRIES LTD.**

**Aboshi.** Feed: acetic acid, methanol. Products: acetic acid (225,000 mt/y), acetic anhydride (120,000 mt/y).

**Fuji, Shizuoka.** Feed: methanol. Product: formaldehyde (190,000 mt/y).

**Ohtake, Hiroshima.** Feed: acetaldehyde, naphtha, propylene. Products: acetic acid (36,000 mt/y), solvents (50,000 mt/y), plasticizers (10,000 mt/y).

**DAINIPPON INK & CHEMICALS INC.**

**Amagasaki, Chiba, Mikawa, Yokkaichi.** Feed: purchased. Products: acrylics (50,000 mt/y), alkyds (42,000 mt/y), butylenes (20,000 mt/y), formaldehyde (100,000 mt/y), polyamide (4,000 mt/y), polyester (70,000 mt/y), polystyrene (84,000 mt/y).

**DENKI KAGAKU KOGYO KABUSHIKI KAISHA**

**Goi, Chiba Prefecture.** Feed: acetic acid, benzene, ethylene, vinyl chloride. Products: ABS (55,000 mt/y), ethylbenzene (185,000 mt/y), polystyrene (113,500 mt/y), polyvinyl chloride (65,000 mt/y), styrene (160,000 mt/y).

**Ohmi, Niigata Prefecture.** Products: polyvinyl alcohol (28,800 mt/y), polyvinyl chloride (24,000 mt/y).

**Shibukawa.** Product: polyvinyl chloride (26,500 mt/y).

**DU PONT-MITSUI POLYCHEMICALS CO. LTD.**
(50% E.I. du Pont de Nemours & Co., 50% Mitsui Petrochemical Ind. Ltd.)

**Chiba.** Feed: ethylene. Product: ld polyethylene (100,000 mt/y).

**Ohtake.** Feed: ethylene. Product: ld polyethylene (42,000 mt/y).

**FUJI OIL CO. LTD.**

**Sodegaura, Chiba.** Feed: naphtha. Product: n-paraffins (8,100 mt/y).

**GENERAL PETROCHEMICAL INDUSTRIES LTD.**

**Osaka.** Feed: FCC, reformate. Products: benzene (30,000 mt/y), n-butylene (50,000 mt/y), propylene (65,000 mt/y), TBA (55,000 mt/y), toluene (120,000 mt/y), xylene mix (150,000 mt/y).

**IDEMITSU PETROCHEMICAL CO. LTD.**

**Chiba.** Feed: naphtha. Products: benzene (150,000 mt/y), paraxylene (130,000 mt/y), hd polyethylene (82,000 mt/y), polyprooylene (80,000 mt/y), polystyrene (30,000 mt/y), styrene (160,000 mt/y).

**Tokuyama.** Feed: naphtha. Products: benzene (180,000 mt/y), cyclohexane (90,000 mt/y), ethylene (380,000 mt/y), polystyrene (60,000 mt/y), propylene (220,000 mt/y), styrene (91,000 mt/y—joint ownership with Nippon Zeon), toluene (74,000 mt/y), xylene mix (102,000 mt/y).

**JAPAN A.G. INTERNATIONAL CHEMICAL CO. LTD.**
(subsidiary of Mitsubishi Gas Chemical Co. Ltd.)

**Mizushima.** Feed: metaxylene. Product: isophthalic acid (35,000 mt/y).

**JAPAN ALDEHYDE CO. LTD.**

**Chiba.** Feed: ethylene. Product: acetaldehyde (69,000 mt/y).

**JAPAN BUTANOL CO. LTD.**

**Yokkaichi.** Product: butanol (30,000 mt/y).

**JAPAN BUTYL CO. LTD.**

**Kashima.** Product: butyl rubber (25,000 mt/y).

**Kawasaki.** Feed: isobutylene, isoprene. Product: butyl rubber (75,000 mt/y).

**JAPAN ETHANOL CO. LTD.**

**Yokkaichi.** Feed: ethylene. Product: ethanol (40,000 mt/y).

**JAPAN LACTAM CO. LTD.**

**Niihama.** Feed: cyclohexene, hydroxylamine. Product: caprolactam (72,000 mt/y).

**JAPAN PHENOL CO. LTD.**

**Kashima.** Feed: cumene. Products: acetone (80,000 mt/y), phenol (130,000 mt/y).

**JAPAN PHTHALIC CO. LTD.**
(subsidiary of Mitsubishi Gas Chemical Co. Ltd.)

**Mizushima.** Feed: orthoxylene. Product: phthalic anhydride (75,000 mt/y).

**JAPAN SYNTHETIC ALCOHOL CO. LTD.**

**Kawasaki.** Feed: ethylene. Product: ethanol (40,000 mt/y).

**JAPAN SYNTHETIC RUBBER CO. LTD.**

**Chiba.** Feed: butadiene. Products: polybutadiene resins (10,000 mt/y), polybutadiene rubber (50,000 mt/y).

**Kashima.** Feed: $C_4$-$C_5$ streams. Products: butadiene (50,000 mt/y), isoprene (30,000 mt/y), polyisoprene (30,000 mt/y), SBR-latex (16,000 mt/y).

**Yokkaichi.** Feed: acrylonitrile, $C_4$ stream, ethylene, propylene, styrene. Products: butadiene (95,000 mt/y), ABS-AES-SAN (142,000 mt/y), polybutadiene, S-SBR (25,000 mt/y), EPR (40,000 mt/y), SB latex (72,000 mt/y), SBR, HSR, NBR (255,000 mt/y).

**KANEGAFUCHI KAGAKU KK**

**Kashima.** Products: polystyrene (22,800 mt/y), polyvinyl chloride (62,000 mt/y).

**Osaka.** Product: polyvinyl chloride (22,000 mt/y).

**Takasago.** Products: polystyrene (28,800 mt/y), polyvinyl chloride (88,000 mt/y), styrene copolymer (41,600 mt/y), vinyl chloride (320,000 mt/y).

**KASHIMA VINYL CHLORIDE MONOMER CO. LTD.**

**Kashima.** Feed: ethylene. Product: vinyl chloride (270,000 mt/y).

**KAWASAKI KASEI CHEMICALS LTD.**

**Kawasaki.** Feed: crude naphthalene, orthoxylene, oxoalcohols, phthalic anhydride. Products: naphthalene (12,000 mt/y), phthalic anhydride (72,000 mt/y), plasticizers (57,000 mt/y),

**KURARAY CO. LTD.**

**Kashima.** Product: polyisoprene (2,500 mt/m).

**Okayama.** Feed: ethylene. Product: polyvinyl alcohol (225 mt/d).

**Nakajo.** Feed: ethylene. Product: polyvinyl alcohol (120 mt/d).

**KURARAY YUKA CO. LTD.**

**Yokkaichi City.** Feed: paraxylene. Product: terephthalic acid (53,000 mt/y).

**KYODO SAKUSAN CO. LTD.**
(subsidiary of Daicel Chemical Industries Ltd.)

**Aboshi, Himeji, Hyogo.** Feed: methanol. Product: acetic acid (225,000 mt/y).

**KYOWA YUKA CO. LTD.**

**Yokkaichi.** Feed: ethylene, propylene. Products: acetaldehyde (125,000 mt/y), acetone (36,000 mt/y), butanol (60,000 mt/y), butyraldehyde (180,000 mt/y), oxoalcohols (100,000 mt/y), plasticizers (100,000 mt/y).

**MITSUBISHI KASEI CORP.**

**Kurosaki.** Feed: coal, LPG, naphtha. Products: ammonia (264,000 mt/y), caprolactam (100,000 mt/y), carbon black (36,000 mt/y), dimethyl terephthalate (80,000 mt/y), nylons (15,000 mt/y), terephthalic acid (270,000 mt/y), urea (264,000 mt/y).

**Mizushima.** Feed: naphtha, LPG. Products: acetaldehyde (120,000 mt/y), acetone (55,000 mt/y), acrylonitrile (112,000 mt/y), alphaolefins (50,000 mt/y), benzene (200,000 mt/y), butanol (25,000 mt/y), cyclohexane (100,000 mt/y), maleic anhydride (21,000 mt/y), oxcalcohols (226,000 mt/y), orthoxylene (27,000 mt/y), paraxylene (60,000 mt/y), ld polyethylene (84,000 mt/y), hd polyethylene (85,000 mt/y), polypropylene (41,000 mt/y), propylene (239,000 mt/y), toluene (60,000 mt/y), vinyl chloride (250,000 mt/y), xylene mix (30,000 mt/y).

**Yokkaichi.** Feed: butadiene, styrene. Products: carbon black (92,000 mt/y), SBR (65,000 mt/y).

**MITSUBISHI GAS CHEMICAL CO. INC.**

**Mizushima.** Feed: mixed xylene. Products: ethylbenzene (60,000 mt/y), metaxylene (50,000 mt/y), orthoxylene (70,000 mt/y), paraxylene (120,000 mt/y), xylene mix (300,000 mt/y), plasticizers (65,000 mt/y).

**Niigata.** Feed: natural gas. Products: ammonia (211,200 mt/y), formaldehyde (220,000 mt/y), methanol (264,000 mt/y), urea (198,000 mt/y).

**MITSUBISHI MONSANTO CHEMICAL CO.**

**Yokkaichi.** Feed: acrylonitrile, styrene, SBR. Products: acrylonitrile-styrene (32,000 mt/y), ABS (60,000 mt/y), polystyrene (160,000 mt/y), polyvinyl butyral (6,000 mt/y).

**MITSUBISHI PETROCHEMICAL CO. LTD.**

**Kashima.** Feed: LPG, naphtha. Products: benzene (221,850 mt/y), cumene (140,000 mt/y), ethylene (387,400 mt/y), ethylene glycol (68,000 mt/y), ethylene oxide (70,000 mt/y), melamine (30,000 mt/y), ld polyethylene (158,900 mt/y), polypropylene (168,000 mt/y), styrene monomer (192,000 mt/y), xylene mix (53,500 mt/y).

**Yokkaichi.** Feed: LPG, naphtha. Products: acrylic acid-esters (54,000 mt/y), alkylbenzene (65,000 mt/y), benzene (221,850 mt/y), ethylene (254,200 mt/y), ethylene glycol (86,000 mt/y), ethylene oxide (85,000 mt/y), oxoalcohols (30,000 mt/y), ld polyethylene (57,100 mt/y), polypropylene (74,000 mt/y), styrene monomer (261,200 mt/y), toluene (24,000 mt/y), xylene (13,000 mt/y).

### MITSUBISHI YUKA BADISCHE CO. LTD.
(joint venture of BASF and Mitsubishi Petrochemical Co. Ltd.)

**Yokkaichi.** Feed: styrene. Product: expandable polystyrene (49,000 mt/y).

### MITSUI PETROCHEMICAL INDUSTRIES LTD.
**Chiba, Iwakuni.** Feed: naphtha, LPG, heavy natural gas liquid. Products: acetaldehyde (36,000 mt/y), acetone (144,000 mt/y), benzene (155,000 mt/y), bisphenol A (60,000 mt/y), butanol (53,000 mt/y), butylenes (22,000 mt/y), ethylene (531,000 mt/y), ethylene glycol (92,000 mt/y), ethylene oxide (92,000 mt/y), phenol (180,000 mt/y), propylene (264,000 mt/y), terephthalic acid (550,000 mt/y), polypropylene (140,000 mt/y), toluene (100,000 mt/y), xylene mix (83,000 mt/y), Polyester (40,000 mt/y), ethylene-propylene rubber (58,500 mt/y).

### MITSUI TOATSU CHEMICALS INC.
**Shimonoseki.** Feed: heavy aromatic oil, coal tar distillate. Product: carbon black (30,000 mt/y).

**Yokoshiba.** Feed: heavy aromatic oil, coal tar distillate. Product: carbon black (45,000 mt/y).

### MIZUSHIMA AROMA CO. LTD.
(subsidiary of Mitsubishi Gas Chemical Co. Ltd.)

**Mizushima.** Feed: paraxylene. Product: terephthalic acid (150,000 mt/y).

### MIZUSHIMA ETHYLENE KK
(50% Mitsubishi Chemical Industries, 50% Sanyo Petrochemicals).

**Mizushima.** Feed: LPG, naphtha. Products: ethylene (440,000 mt/y), propylene (239,000 mt/y).

### NIHON ALKYLATE CO. LTD.
(Sumitomo Chemical Co. and Kao Soap Co.).

**Niihama.** Feed: benzene. Product: alkylbenzene (30,000 mt/y).

### NIHON OXIRANE CO. LTD.
(Atlantic Richfield, Sumitomo Chemical, Showa Denko).

**Chiba.** Feed: ethylbenzene, propylene. Products: propylene oxide (143,000 mt/y), styrene (344,000 mt/y).

### NIHON POLYSTYRENE CO. LTD.
**Kawasaki.** Feed: styrene. Product: polystyrene (58,000 mt/y).

### NIPPON CARBIDE INDUSTRIES CI
**Toyama.** Feed: acrylic acid-esters, formaldehyde, melamine, styrene, vinyl acetate-chloride. Products: acrylics, polyvinyl chloride.

### NIPPON KASEI CHEMICAL CO. LTD.
**Onahama, Fukushima.** Feed: creosote oil, methanol. Products: carbon black (30,000 mt/y), formaldehyde (96,000 mt/y).

### NIPPON MINING CO. LTD.
**Mizushima.** Feed: reformate. Products: n-paraffins (80,000 mt/y), propylene (80,000 mt/y), xylene mix (70,000 mt/y).

**Nagoya.** Feed: reformate. Products: benzene (112,000 mt/y), cyclohexane (80,000 mt/y), paraxylene (100,000 mt/y), propylene (20,000 mt/y), toluene (120,000 mt/y), xylene mix (123,000 mt/y).

### NIPPON OIL AND FATS CO.
**Oita.** Feed: $C_4$, butane. Products: maleic anhydride (12,000 mt/y), polybutylene (7,300 mt/y).

### NIPPON PETROCHEMICALS CO. LTD.
**Kawasaki and Ukishima.** Feed: LPG, naphtha. Products: benzene (72,000 mt/y), butadiene (60,000 mt/y), isopropanol (60,000 mt/y), n-paraffins (75,000 mt/y), ld polyethylene (95,000 mt/y), toluene (42,000 mt/y), xylene (34,000 mt/y).

### NIPPON PETROLEUM DETERGENT CO. LTD.
(50% Nippon Petrochemicals Co., 50% Chevron Chemical Co.)

**Kawasaki.** Feed: benzene, n-paraffin, propylene. Product: alkylbenzene (90,000 t/y).

### NIPPON POLYURETHANE INDUSTRIAL CO. LTD.
**Shin-Nanyo, Yamaguchi.** Product: polyester (7,200 t/y).

### NIPPON SHOKUBAI KAGAKU KOGYO CO. LTD.
**Himeji.** Feed: benzene, naphthalene, orthoxylene, propylene. Products: acrylic acid-acrylic esters (164,000 mt/y), ethylene glycol (185,000 mt/y), ethylene oxide (185,000 mt/y), maleic anhydride (26,000 mt/y), phthalic anhydride (40,000 mt/y).

**Kawasaki.** Feed: ethylene. Products: ethylene glycol (185,000 mt/y), ethylene oxide (185,000 mt/y).

**Suita.** Feed: ethylene glycols, phthalic anhydride, styrene. Product: alkyds, polyester (48,000 mt/y).

### NIPPON ZEON CO. LTD.
**Kawasaki.** Feed: acrylonitrile, butadiene, styrene. Products: NBR (30,000 mt/y), SBR (30,000 mt/y).

**Mizushima.** Feed: vinyl chloride. Product: polyvinyl chloride (130,000 mt/y).

**Takaoka.** Feed: vinyl chloride. Product: polyvinyl chloride (80,000 mt/y).

**Tokuyama.** Feed: $C_4$ stream. Products: butadiene (140,000 mt/y), polybutylene (48,000 mt/y), EBR (10,000 mt/y), SBR-NBR-HS (190,000 mt/y)

### NISSAN CHEMICAL INDUSTRIES LTD.
**Toyama.** Feed: LPG, naphtha. Products: ammonia (113,000 mt/y), melamine (42,000 mt/y), urea (127,000 mt/y).

### NISSAN MARUZEN POLYETHYLENE CO. LTD.
**Goi, Chiba.** Feed: ethylene. Product: hd polyethylene (70,000 mt/y).

### NISSAN NALKEN CORP.
**Chiba, Pref.** Feed: benzene, n-paraffin. Product: alkylbenzene (40,000 mt/y).

### NISSAN PETROCHEMICAL LTD.
**Goi, Chiba.** Feed: ethylene, olefins, propylene. Products: oxoalcohols (80,000 mt/y), polyvinyl chloride (55,000 mt/y), vinyl chloride (60,000 mt/y).

### NISSO MARUZEN CHEMICAL CO. LTD.
**Goi, Ichihara.** Feed: ethylene, propylene oxide. Products: ethylene glycol (70,000 mt/y), ethylene oxide (70,000 mt/y), propylene glycol (22,000 mt/y).

### NISSO PETROCHEMICAL INDUSTRIES CO. LTD.
**Yokkaichi.** Feed: ethylene. Products: ethylene glycol (60,000 mt/y), ethylene oxide (60,000 mt/y).

### OKAYAMA BUTADIENE CO. LTD.
(Joint venture of Nippon Zeon Co. Ltd. and Asahi Chemical Industry Co. Ltd.)

**Mizushima.** Feed: $C_4$ stream. Product: butadiene (140,000 mt/y).

### OSAKA GAS CO. LTD.
**Osaka.** Feed: coke oven gas oil. Products: benzene (56,000 mt/y), naphthalene (11,000 mt/y), toluene (5,000 mt/y).

### OSAKA PETROCHEMICAL INDUSTRIES LTD.
**Takaishi City, Osaka.** Feed: naphtha. Products: aromatics (130,000 mt/y), ethylene (332,000 mt/y), propylene (220,000 mt/y).

### SANYO ETHYLENE CO. LTD.
**Mizushima.** Feed: naphtha. Products: ethylene (390,000 mt/y), propylene (254,000 mt/y).

### SANYO MONOMER CO. LTD.
(joint venture of Nippon Zeon Co. Ltd., Asahi Chemical Co., Chisso Corp.)

**Mizushima.** Feed: ethylene, chlorine. Products: vinyl chloride (175,000 mt/y).

### SEITETSU KAGAKU CO. LTD.
**Befu.** Products: formaldehyde (32,400 mt/y).

**Himeji.** Products: formaldehyde (107,000 mt/y), methanol (165,000 mt/y).

### SENBOKU POLYMER CO. LTD.
(50% Mitsui Toatsu, 35% Nippon Petrochemicals, 15% Asahi Chemicals).

**Osaka.** Product: polypropylene (80,000 mt/y).

### SHIN-DAIKYOWA PETROCHEMICAL CO. LTD.
(Daikyo Oil Co. Ltd., Tosoh Corp., Kyowa Hakko Kogyo Co. Ltd., Dainippon Ink and Chemicals Inc., Industrial Bank of Japan).

**Yokkaichi.** Feed: naphtha. Products: aromatics (124,000 mt/y), benzene (90,000 mt/y), butadiene (44,000 mt/y), cumene (140,000 mt/y), ethylene (300,000 mt/y), ethylbenzene (130,000 mt/y), propylene (160,000 mt/y), styrene (91,000 mt/y), toluene (60,000 mt/y), xylene mix (50,000 mt/y).

### SHIN-ETSU CHEMICAL CO. LTD.
**Kashima.** Feed: vinyl chloride. Product: polyvinyl chloride (198,000 mt/y).

**Shin-Nanyo.** Feed: vinyl chloride. Product: polyvinyl chloride (42,000 mt/y).

### SHIN-ETSU VINYL ACETATES CO. LTD.
**Sakai.** Feed: acetic acid, ethylene. Product: vinyl acetate (80,000 mt/y).

### SHOWA ACETYL CHEMICAL CO. LTD.
**Ohita.** Feed: ethylene. Products: acetaldehyde (100,000 mt/y), acetic acid (130,000 mt/y), vinyl acetate (80,000 mt/y).

### SHOWA DENKO KK
**Kawasaki.** Feed: LPG. Products: acrylonitrile (51,200 mt/y), ammonia (197,200 mt/y), propylene oxide (35,000 mt/y), polystyrene (57,600 mt/y) .

**Ohita.** Feed: naphtha. Products: acetaldehyde (130,000 mt/y), acetic acid (100,000 mt/y), ethylene (584,000 mt/y), hd polyethylene (152,000 mt/y), ld polyethylene (120,000 mt/y), polypropylene (138,000 mt/y), propylene (351,000 mt/y), vinyl acetae (80,000 mt/y).

### SHUNAN CHEMICAL CO. LTD.
**Tokuyama City.** Products: ethylene dichloride (130,000 mt/y), propylene oxide (40,000 mt/y).

### SUMITOMO CHEMICAL CO. LTD.
**Chiba.** Feed: butane, LPG, naphtha. Products: benzene (100,000 mt/y), ethylene (357,500 mt/y), polyethylene (182,800 mt/y), polyisoprene (170,000), propylene (144,000 mt/y), polyvinyl chloride (49,800 mt/y), propylene (255,100 mt/y), toluene (60,000 mt/y), xylene (40,000 mt/y), SBR (50,200 mt/y), ethylene-propylene rubber (35,000 mt/y).

**Niihama.** Feed: butane, naphtha. Products: acrylic acid-esters (40,000 mt/y), acrylonitrile (52,000 mt/y), polyvinyl chloride (19,300 mt/y).

### SUN ARROW CHEMICAL CO. LTD.
(Tokuyama Soda Co. Ltd.)

**Tokuyama.** Feed: ethylene dichloride. Products: polyvinyl chloride (85,000 mt/y), vinyl chloride (180,000 mt/y).

### TAKEDA CHEMICAL INDUSTRIES LTD.
**Kashima.** Feed: benzene. Product: maleic anhydride (16,500 t/y).

**Shimizu.** Feed: butadiene, styrene maleic anhydride, propylene glycol. Products: polyester (27,500 mt/y), SBR (20,000 mt/y).

### TEIJIN HERCULES CHEMICAL CO. LTD.
**Ehime.** Feed: paraxylene. Product: dimethyl terephthalate (140,000 mt/y).

**Matsuyama.** Feed: paraxylene. Product: dimethyl terephthalate (60,000 mt/y),.

**Tokuyama.** Feed: paraxylene. Product: dimethyl terephthalate (75,000 mt/y).

**TEIJIN PETROCHEMICAL INDUSTRIES LTD.**

**Ehime.** Feed: mixed xylenes. Products: orthoxylene (30,000 mt/y), paraxylene (170,000 mt/y).

**Tokuyama.** Feed: mixed xylene. Products: ethylbenzene (20,000 mt/y), orthoxylene (30,000 mt/y), paraxylene (35,000 mt/y).

**TOBU BUTADIENE CO. LTD.**
(50% Japan Synthetic Rubber, 50% Sumitomo Chemical)

**Chiba.** $C_4$ stream. Product: butadiene (80,000 mt/y).

**TOHO RIKA KOGYO KK**

**Minato, Nagoya.** Feed: methanol, orthoxylene. Products: formaldehyde (80,000 mt/y), phthalic anhydride (30,000 mt/y), plasticizers (50,000 mt/y).

**TOKUYAMA PETROCHEMICAL CO. LTD.**

**Shin-Nanyo.** Feed: ethylene. Products: acetaldehyde (100,000 mt/y), acetic acid (60,000 mt/y).

**TOKUYAMA SODA CO. LTD.**

**Tokuyama.** Feed: propylene. Products: ethylene dichloride (132,000 mt/y), isopropanol (36,000 mt/y), polypropylene (95,000 mt/y), propylene oxide (36,000 mt/y).

**TOKUYAMA STYRENE MONOMER CO. LTD.**
(jointly owned by Idemitsu Petrochemical Co. Ltd., and Nippon Zeon Co. Ltd.)

**Tokuyama.** Feed: benzene, ethylene. Product: styrene (91,000 mt/y).

**TOMAKOMAI SODA CO. LTD.**
(Nippon Zeon, Hokkaido Soda, Maruzen Petrochemical, Nippon Light Metal, Nissho Iwai, Asahi Denka)

**Tomakomai.** Feed: ethylene. Product: ethylene dichloride (120,000 mt/y).

**TONEN PETROCHEMICAL CO. LTD.**

**Kawasaki.** Feed: naphtha, LPG. Products: butadiene (100,000 mt/y), butanol (8,000 mt/y), butyraldehyde (50,000 mt/y), ethylene (393,000 mt/y), oxoalcohols (40[illegible] mt/y), hd polyethylene (70,000), propyle[illegible]0,000 mt/y), polypropylene (180,000 mt/y), [illegible]000 mt/y), pyrolysis gasoline (170[illegible]), fuel oils(32,000 mt/y).

**Wakayama.** Feed: reformate. Products: benzene (55,000 mt/y), orthoxylene (65,000 mt/y), paraxylene (190,000 mt/y), toluene (110,000 mt/y).

**TORAY INDUSTRIES INC.**

**Chiba.** Feed: acrylonitrile, butadiene, styrene. Product: ABS (55,000 mt/y).

**Kawasaki.** Feed: benzene, toluene, xylene mix. Products: benzene (85,000 mt/y), cyclohexane (150,000 mt/y), orthoxylene (100,000 mt/y), paraxylene (200,000 mt/y), xylene mix (39,000 mt/y).

**Nagoya.** Feed: cyclohexane, paraxylene. Products: caprolactam (130,000 mt/y), nylon (26,400 mt/y), terephthalic acid (100,000 mt/y).

**TOSOH CORP.**

**Shin-Nanyo, Yamagata. Yokkaichi, Mie, Toyama, Hyuga.** Products: ld polyethylene (86,000 mt/y), hd polyethylene (72,000 mt/y), vinyl chloride (400,000 mt/y), solvents (27,000 mt/y).

**TOYO CONTINENTAL CARBON LTD.**
(subsidiary of Witco Corp.)

**Shimonoseki.** Feed: heavy aromatic oils. Product: carbon black (15,000 mt/y).

**Yokoshiba.** Feed: heavy aromatic oils. Product: carbon black (45,000 mt/y).

**UBE INDUSTRIES LTD.**

**Ichihara, Chiba.** Feed: butadiene, ethylene. Products: polybutadiene (60,000 mt/y), ld polyethylene (147,000 mt/y).

**Sakai, Osaka.** Feed: benzene, LPG, LNG, naphtha, propylene. Products: ammonia (234,600 mt/y), caprolactam (90,000 mt/y), cyclohexane (100,000 mt/y), polypropylene (105,000 mt/y), urea (95,200 mt/y).

**Ube, Yamaguchi.** Feed: benzene. Products: caprolactam (90,000 mt/y), cyclohexane (58,000 mt/y), nylon 6 (24,600 mt/y), nylon 66 (2,400 mt/y), nylon 12 (2,400 mt/y).

**UKISHIMA AROMATIC CHEMICALS CO. LTD.**
(100% Nippon Petrochemicals Co. Ltd.)

**Ukishima.** Feed: benzene, $C_8$s, reformate. Products: cyclohexane (150,000 mt/y), orthoxylene (100,000 mt/y), paraxylene (200,000 mt/y).

**UKISHIMA PETROCHEMICALS CO. LTD.**
(50% Nippon Petrochemicals Co. Ltd., 50% Mitsui Petrochemical Industries)

**Ukishima.** Feed: LPG, naphtha. Products: ethylene (312,000 mt/y), propylene (172,000 mt/y).

**UNITIKA CHEMICAL CO.**

**Sakai.** Feed: vinyl chloride. Product: polyvinyl alcohol (24,000 mt/y).

**YUKA MELAMINE CO. LTD.**

**Kashima.** Feed: urea. Product: melamine (30,000 mt/y).

**ZEON ISOPRENE CO. LTD.**
(Subsidiary of Nippon Zeon)

**Mizushima.** Feed: $C_5$ stream, isoprene. Products: isoprene (45,000 mt/y), polyisoprene (37,000 mt/y), $C_5$ resin.

## JORDAN

**INTERMEDIATES PETROCHEMICALS INDUSTRIES CO. LTD.**

**Zarqa.** Feed: glycols, maleic-phthalic anhydrides, oxoalcohols, polyvinyl chloride, styrene. Products: polyesters (8,000 mt/y), plasticizers (4,000 mt/y).

## KOREA

**DAELIM INDUSTRIAL CO. LTD.**

**Yeo-Chon, Chun-Nam.** Feed: naphtha. Products: aromatics (148,000 mt/y), benzene (74,000 mt/y), ethylene (350,000 mt/y), propylene (187,000 mt/y), styrene (100,000 mt/y), toluene (44,000 mt/y), xylene mix (30,000 mt/y).

**DAINONG PETROCHEMICAL INDUSTRY CO. LTD.**
(joint venture Dainong Co. Ltd., Mitsui Toatsu Chemicals Inc., Toyo Menka Kaisha Ltd.)

**Ulsan.** Feed: benzene. Product: maleic anydride (12,000 mt/y).

**HAN YANG CHEMICAL CORP.**

**Yeochun, Jinhae, Ulsan.** Feed: ethylene. Products: plasticizers (46,000 mt/y). polyethylene (450,000 mt/y). polyvinyl chloride (260,000 mt/y), vinyl chloride (210,000 mt/y).

**HANKOOK CAPROLACTAM CORP.**

**Ulsan.** Feed: cyclohexane. Product: caprolactam (80,000 mt/y).

**HANNAM CHEMICAL CORP.**

**Ulsan.** Feed: acrylonitrile, butadiene, propylene oxide, styrene. Product: ABS (40,000 mt/y), polystyrene (180,000 mt/y), propylene glycol (20,000 mt/y), SAN (20,000 mt/y).

**HONAM OIL REFINERY CO. LTD.**

**Yeosu.** Feed: crude oil. Products: aromatics mix (460,000 mt/y), benzene (100,000 mt/y), toluene (60,000 mt/y), paraxylene (200,000 mt/y), xylene mix (100,000 mt/y), polypropylene (165,000 mt/y).

**ISU CHEMICAL CO. LTD.**

**Ulsan.** Feed: benzene, n-paraffin, n-olefin, propylene tet. Product: alkylbenzene (100,000 mt/y).

**KOHAP CHEMICAL CORP.**

**Ulsan.** Feed: virgin xylene. Products: benzene (30,000 mt/y), orthoxylene (30,000 mt/y), paraxylene (160,000 mt/y).

**KOREA FERTILIZER CO. LTD.**

**Ulsan.** Feed: naphtha. Products: ammonia (195,000 mt/y), melamine (18,000 mt/y), urea (330,000 mt/y).

**KOREA KUMHO PETROCHEMICAL CO. LTD.**

**Ulsan and Yeochun.** Feed: $C_4$, butadiene, styrene. Products: butadiene (70,000 mt/y), polybutadiene (35,000 mt/y), SBR (130,000 mt/y).

**KOREA PETROCHEMICAL INDUSTRIES CO. LTD.**

**Ulsan.** Feed: ethylene, propylene. Products: hd polyethylene (70,000 mt/y), polypropylene (120,000 mt/y).

**KOREA POLYOL CO. LTD.**

**Ulsan.** Feed: ethylene oxide, propylene oxide. Products: polyester polyol (50,000 mt/y), ethoxylates (5,000 mt/y), polyethylene glycol (5,000 mt/y).

**KUMHO SHELL CHEMICAL CO.**
(Shell 50%, KKPC 50%)

**Yeochon.** Products: acetone (15,000 mt/y), cumeme (40,000 mt/y), epoxy resins, DPP, phenol (25,000 mt/y).

**LUCKY ADVANCED MATERIAL INC.**
(Licensee of Witco Corp.—Concarb Div.)

**Bupyong.** Feed: heavy aromatic oil, coal tar distillate. Product: carbon black (30,000 mt/y).

**Yosu.** Feed: heavy aromatic oil, coal tar distillate. Product: carbon black (105,000 mt/y).

**LUCKY LTD.**

**Na-Ju and Yeochun.** Products: acrylic acid-esters (77,000 mt/y), oxoalcohols (99,000 mt/y).

**NAMHAE CHEMICAL CORP.**

**Yosu City, Chunnam.** Feed: naphtha. Products: ammonia (627,000 mt/y), urea (690,000 mt/y).

**SAMKYUNG CHEMICAL CO. LTD.**

**Ulsan.** Feed: butanol, orthoxylene, phthalic anhydride, 2-ethyl hexanol. Product: maleic anhydride (3,000 mt/y), phthalic anhydride (70,000 mt/y), plasticizers (70,000 mt/y).

**TONG SUH PETROCHEMICAL CORP. LTD.**

**Ulsan.** Feed: ammonia, propylene. Product: acrylonitrile (83,000 mt/y).

**YONG-NAM CHEMICAL CO. LTD.**

**Ulsan.** Feed: naphtha. Product: ammonia (310 mt/d), urea (375 mt/d).

**YUKNOG ARCO CHEMICAL LTD.**

**Ulsan.** Products: propylene oxide (110,000 mt/y). styrene monomer (247,500 mt/y), propylene glycols (27,500 mt/y), polyols (20,000 mt/y).

**YUKONG LTD.**

**Ulsan.** Feed: naphtha. Products: aromatics (70,000 mt/y), benzene (194,000 mt/y), butadiene (24,000 mt/y), cyclohexane (40,000 mt/y), ethylene (155,000 mt/y), fuel oils (18,000 mt/y), propylene (81,000 mt/y). pyrolysis gasoline (128,000 mt/y), toluene (270,000 mt/y), xylene mix (297,000 mt/y).

## KUWAIT

**PETROCHEMICAL INDUSTRIES CO.**

**Shuaiba.** Feed: natural gas. Products: ammonia (3,000 mt/d), urea (2,400 mt/d).

## LIBYA

**Ras Lanuf.** Product: ethylene (350,000 mt/y).

## MADAGASCAR

**N-REN CORP.**

**Tamatave.** Feed: naphtha. Product: ammonia (175 mt/d).

**ZE-REN**

**Tamatave.** Product: urea (90,000 mt/y).

## MALAYSIA

**BORDEN CHEMICAL**

**Prai.** Feed: methanol, phenol, urea. Product: formaldehyde (20,000 mt/y).

**MALAYSIAN CARBON SDN. BHD.**
(Subsidiary of Cabot Corp.)
**Port Dickson.** Feed: heavy aromatic oil. Product: carbon black.

## MEXICO

**CELANESE MEXICANA SA**
**Cangrejera.** Products: acetic acid (119,000 mt/y), acetic anhydride (45,000 mt/y), acetone (60,000 mt/y), amines (9,500 mt/y), butanol (16,000 mt/y), butyraldehyde (90,000 mt/y), DMF (7,500 mt/y), vinyl acetate (31,000 mt/y).

**Celaya.** Products: acetic acid (63,000 mt/y), acetic anhydride (45,000 mt/y), acetone (14,000 mt/y), butanol-n (38,000 mt/y), 2-ethyl hexanol (70,000 mt/y), MEK & esters (30,000 mt/y), mesityl oxide (22,000 mt/y), vinyl acetate (30,000 mt/y).

**Cosoleacaque.** Product: acrylic acid-esters (30,000 mt/y).

**Lerma.** Products: phthalic anhydride (23,500 mt/y), plasticizers (22,500 mt/y).

**Ocotlan.** Products: polyamide (16,860 mt/y), polyester (14,500 mt/y).

**Queretaro.** Products: polyamide (7,000 mt/y), polyester (94,000 mt/y).

**Toluca.** Products: polyamide (12,000 mt/y), polyester (23,600 mt/y).

**Zacapu.** Product: polypropylene (4,700 mt/y).

**DERIVADOS MALEICOS SA DE CV**
**Puebla.** Feed: benzene. Product: maleic anhydride (7,000 mt/y).

**FENOQUIMIA SA**
(75% Industrias Resistol, 25% Promociones Industriales Banamex)
**Cosoleacaque, Ver.** Feed: cumene, cyanhidric acid, methanol. Products: acetone (23,000 mt/y), acrylics (16,500 mt/y), phenol (38,000 mt/y).

**FERTILIZANTES MEXICANOS SA**
**Camargo.** Feed: ammonia, $CO_2$. Product: urea (75,000 mt/y).

**Coatzacoalcos (Pajaritos).** Feed: ammonia, carbon dioxide. Product: urea (990,000 mt/y)

**Minatitlan.** Feed: ammonia, carbon dioxide. Product: urea (302,000 mt/y).

**Salamanca.** Feed: ammonia, carbon dioxide. Product: urea (386,000 mt/y).

**GLICOLES MEXICANOS SA DE CV**
**Apizaco, Tlaxcala.** Feed: ethylene oxide. Product: ethylene glycol (100,000 mt/y).

**HULES MEXICANOS SA**
(owned by Pemex and Polysar Ltd.)
**Altamira, Tam.** Feed: styrene, butadiene, acn. Product: SBR (45,000 mt/y).

**INDUSTRIAS DERIVADAS DEL ETILENO SA**
**Puebla, Pue.** Feed: ethylene oxide, propylene oxide. Products: ethanolamines (7,000 mt/y), ethylene glycol (30,000 mt/y), propylene glycol (10,000 mt/y), phthalic anhydride (42,000 mt/y), polystyrene (50,000 mt/y), plasticizers (7,000 mt/y).

**INDUSTRIAS RESISTOL SA**
**Coatzacoalcos.** Feed: styrene. Product: phenol (38,000 mt/y), acrylics (16,500 mt/y).

**Lecheria.** Feed: acrylonitrile, butadiene, styrene. Products: ABS (24,000 mt/y), SBR (4,500 mt/y).

**Lerma.** Feed: butadiene, methanol, styrene monomer. Products: formaldehyde (28,500 mt/y), SBR (16,500 mt/y).

**Xicohtzingo.** Feed: styrene. Product: polystyrene (26,000 mt/y).

**NEGROMEX SA**
**Salamanca.** Feed: aromatic oils, butadiene, styrene. Products: carbon black (49,600 mt/y), rubber (70,000 mt/y).

**PETROCEL SA**
**Altamira, Tamps.** Feed: methanol, paraxylene Products: dimethyl terephthalate (270,000 mt/y), terephthalic acid (55,000 mt/y).

**PETROLEOS MEXICANOS**
**Azcapotzalco.** Feed: benzene, propylene tet, refinery gas. Products: alkylbenzene (36,500 mt/y), propylene (27,000 mt/y), propylene tet (17,500 mt/y), heavy alkyl-aryl (3,700 mt/y).

**Cadereyta, N.L.** Feed: refinery gas. Product: propylene (45,000 mt/y).

**Camargo, Chihuahua.** Feed: natural gas. Product: ammonia (132,000 mt/y).

**Ciudad Madero, Tamaulipas.** Feed: benzene, butylenes, ethylene, refinery gas. Products: alkylbenzene (31,600 mt/y), butadiene (55,000 mt/y), ethylbenzene (39,400 mt/y), propylene (61,000 mt/y), propylene tet (19,000 mt/y), styrene (30,000 mt/y).

**Cosoleacaque, Veracruz.** Feed: natural gas, propylene. Products: acrylonitrile (24,000 mt/y), ammonia (2,380,000 mt/y), paraxylene (40,000 mt/y).

**La Cangrejera, Veracruz.** Feed: benzene, ethylene, naphtha, propylene. Product: acetaldehyde (100,000 mt/y), aromatics mix (22,000 mt/y), benzene (275,000 mt/y), cumene (40,000 mt/y), ethylbenzene (187,500 mt/y), ethylene (500,000 mt/y), ethylene glycol (3,800 mt/y), ethylene oxide (100,000 mt/y), orthoxylene (55,000 mt/y), paraxylene (240,000 mt/y), ld polyethylene (240,000 mt/y), propylene (26,900 mt/y), styrene (150,000 mt/y), toluene (365,000 mt/y), xylene mix (360,000 mt/y).

**Minatitlan, Veracruz.** Feed: benzene, ethylene, naphtha, refinery gas. Products: aromatics mix (44,000 mt/y), benzene (124,250 mt/y), cyclohexane (100,000 mt/y), ethylbenzene (17,550 mt/y), orthoxylene (11,250 mt/y), propylene (53,000 mt/y), toluene (100,000 mt/y), xylene mix (40,610 mt/y).

**Morelos, Veracruz.** Feed: ethane, ethylene. Product: ethylene (500,000), ethylene oxide (200,000 mt/y), propylene (26,900 mt/y), hd polyethylene (50,000 mt/y).

**Pajaritos, Veracruz.** Feed: ethylchloride, ethylene. Products: acetaldehyde (44,000 mt/y), ethylene (209,210 mt/y), ethylene dichloride (420,650 mt/y), ethylene oxide (28,000 mt/y), vinyl chloride (30,000 mt/y).

**Poza Rica, Veracruz.** Feed: ethylene. Products: ethylene (182,000 mt/y), ld polyethylene (51,000 mt/y), hd polyethylene (100,000 mt/y).

**Reynosa, Tamaulipas.** Feed: ethylene. Products: ethylene (27,210 mt/y), ld polyethylene (18,000 mt/y).

**Salamanca, Guanajuato.** Feed: natural gas, propylene. Products: ammonia (379,000 mt/y), isopropanol (15,000 mt/y), propylene (48,000 mt/y).

**Salina Cruz, Oax.** Feed: refinery gas. Product: propylene (45,000 mt/y).

**San Martin, Texmelucan, Puebla.** Feed: benzene, natural gas, propylene tet. Products: acrylonitrile (50,000 mt/y), alkylbenzene (70,000 mt/y), methanol (171,500 mt/y), propylene tet (80,000 mt/y), heavy alkyl-aryl (5,980 mt/y).

**Tula, Hidalgo.** Feed: ammonia, natural gas, propylene. Products: acrylonitrile (50,000 mt/y), propylene (45,000 mt/y).

**POLICYD SA de CV**
**Mexico City and Tampico.** Feed: vinyl chloride monomer. Product: polyvinyl chloride (135,000 mt/y).

**POLIMEROS DE MEXICO SA**
**Moyotzingo, Puebla.** Feed: vinyl chloride. Product: polyvinyl chloride (30,000 mt/y).

**Xicohtzingo.** Feed: vinyl chloride. Product: polyvinyl chloride (30,000 mt/y).

**POLIOLES SA DE CV**
(60% Mexican shareholders, 40% BASF de Mexico)
**Lerma (State of Mexico).** Feed: ethylene oxide, propylene oxide. Products: ethylene glycol, propylene oxide.

**POLIESTIRENO Y DERIVADOS SA de CV**
**Apizaco, Tlaxcala.** Feed: styrene: Product: polystyrene (50,000 mt/y).

**POLIVIN SA DE CV**
**Celaya, Guanajuato.** Feed: methanol, vinyl acetate. Product: polyvinyl alcohol (2,400 mt/y).

**SÍNTESIS ORGÁNICAS SA**
**Apizaco, Tlaxcala.** Feed: orthoxylene. Product: phthalic anhydride (30,000 mt/y).

**Puebla, Pue.** Feed: orthoxylene, 2-ethyl hexanol. Products: phthalic anhydride (12,000 mt/y), plasticizers (15,000 mt/y).

**UNIVEX SA**
(DSM affiliate)
**Salamanca, Gto.** Product: caprolactam (50,000 mt/y).

## MOROCCO

**SNEP**—Societe Nationale d'Electrolyse et de Petrochemie.
**Mohammedia.** Products: polyvinyl chloride (25,000 mt/y), vinyl acetate (25,000 mt/y).

## NETHERLANDS

**AKZO ZOUT CHEMIE NEDERLAND BV**
**Botlek.** Feed: ethylene, chlorine, HCl. Product: vinyl chloride (500,000 mt/y).

**AMMONIAK UNIE**
(Kemira/BASF)
**Pernis.** Feed: natural gas. Product: ammonia (380,000 mt/y).

**ARCO CHEMIE NEDERLAND LTD.**
(100% Arco Chemical Co.)
**Rotterdam.** Feed: isobutane and propylene. Products: TBA (648,000 mt/y), isobutylene (330,000 mt/y), MTBE (9,400 b/d), propylene glycol (71,500 mt/y), propylene oxide (270,000 mt/y).

**BREDASE POLYSTYREEN MBV.**
**Breda.** Feed: styrene. Product: polystyrene (150,000 mt/y).

**CINDU CHEMICALS BV**
**Uithoorn (near Amsterdam).** Feed: coal tar. Product: naphthalene (10,000 mt/y).

**DEGUSSA.**
**Botlek.** Feed: aromatic hydrocarbons, coal tar oil. Product: carbon black.

**DOW CHEMICAL EUROPE**
**Terneuzen.** Products: benzene, butadiene, cumene, ethylene, ethylbenzene, ethylene glycol, ethylene oxide, ld-lld polyethylene, polystyrene, propylene, SB-latex, styrene.

**DSM**
Chemical Products Division
**South Limburg.** Products: acetylene (2,200 mt/y), acrylonitrile (180,000 mt/y), caprolactam (230,000 mt/y), melamine (60,000 mt/y).
**Chemische Industrie Rijnmond**
**Botlek.** Feed: toluene. Product: phenol (160,000 mt/y).
**Methanol Chemie Nederland VoF**
**Delfzijl and Rotterdam.** Products: formaldehyde (120,000 mt/y), resins (200,000 mt/y).
**Methanor VoF.**
**Delfzijl.** Product: methanol (740,000 mt/y).
Polymer Division
**South Limburg.** Feed: $C_4$, $C_5$, naphtha, gas oil. Products: benzene (200,000 mt/y), butadiene (110,000 mt/y), EPDM rubber (60,000 mt/y), ethylene (850,000 mt/y), MTBE (40,000 mt/y), ld polyethylene (370,000 mt/y), hd polyethylene (220,000 mt/y), polypropylene (140,000 mt/y), polyvinyl chloride (195,000 mt/y), propylene (470,000 mt/y), ABS (50,000 mt/y).

**DSM AGRO BV**
**Geleen.** Feed: natural gas. Products: ammonia (800,000 mt/y), urea (480,000 mt/y).

**IJmuiden.** Feed: natural gas. Product: ammonia (290,000 mt/y).

**Rotterdam.** Feed: natural gas. Product: ammonia (150,000 mt/y DSM—150,000 mt/y BASF).

**HOECHST HOLLAND NV**

**Vlissingen.** Feed: p-xylene, methanol. Product: dimethyl terephthalate (90,000 mt/y).

**HYDRO AGRI SLUISKILL B.V.**

**Sluiskil.** Feed: natural gas. Products: ammonia (1,500,000 mt/y), urea (800,000 mt/y).

**ICI HOLLAND BV**

**Rozenburg.** Product: polypropylene (120,000 mt/y).

**KEMIRA BV**

(subsidiary of Kemira Oy)

**Rozenburg.** Feed: natural gas. Products: ammonia (550,000 mt/y), urea (210,000 mt/y).

**SHELL NEDERLAND CHEMIE BV**

**Moerdijk.** Feed: gas oil, LPG, naphtha. Products: butadiene (115,000 mt/y), ethylbenzene (350,000 mt/y), ethylene (550,000 mt/y), ethylene glycol (160,000 mt/y), ethylene oxide (185,000 mt/y), propylene (300,000 mt/y), propylene oxide (125,000 mt/y), styrene (320,000 mt/y).

**Pernis.** Feed: naphtha. Products: acetone (150,000 mt/y), bisphenol A (90,000 mt/y), BR-latex (20,000 mt/y), ethylene glycol (55,000 mt/y), isopropanol (290,000 mt/y), MEK (60,000 mt/y), methyl isobutyl ketone (30,000 mt/y), isoprene rubber (40,000 mt/y), MTBE (125,000 mt/y), polyether polyols (80,000 mt/y), polypropylene (90,000 mt/y), polyvinyl chloride (200,000 mt/y), propylene (90,000 mt/y), SBR (120,000 mt/y).

**UCAM VOF**

(2/3 DSM, 1/3 Kemira)

**Geleen.** Feed: natural gas. Product: ammonia (460,000 mt/y).

## NEW ZEALAND

**PETRALGAS CHEMICALS NZ LTD.**

**Waitara.** Feed: natural gas. Product: methanol (1,450 mt/d).

**PETROCHEMICAL CORP. OF NZ LTD.**

**Kapuni.** Feed: natural gas. Product: urea (165,000 mt/y).

## NICARAGUA

**QUÍMICA BORDEN CASA**

**Tipitapa.** Feed: methanol. Product: formaldehyde (6,000 mt/y).

## NIGERIA

**NIGERIAN NATIONAL PETROLEUM CORP.**

**Ekpan and Kaduna.** Feed: FCC decant oil, benzene, ethylene, kerosine, refinery off gas. Products: alkylbenzene (30,000 mt/y), benzene (15,000 mt/y), carbon black (18,000 mt/y), polypropylene (35,000 mt/y).

## NORWAY

**I/S NORETYL**

(51% Norsk Hydro, 49% Statoil)

**Rafnes, Bamble.** Feed: natural gas liquids. Products: ethylene (390,000 mt/y), propylene (70,000 mt/y).

**NORSK HYDRO as**

**Porsgrunn.** Feed: vinyl chloride. Product: polyvinyl chloride (90,000 mt/y).

**Rafnes, Bamble.** Feed: chlorine, ethylene. Product: vinyl chloride (420,000 mt/y).

**NORSK HYDRO NORWAY**

**Porsgrunn.** Feed: natural gas liquids. Product: ammonia (420,000 mt/y).

**NORSK KOKSVERK AS**

**Mo-i-Rana.** Feed: coke oven gas. Products: ammonia (40,000 mt/y), benzene (5,000 mt/y), crude tar (16,000 mt/y).

## PAKISTAN

**DAWOOD HERCULES CHEMICALS LTD.**

**Chichoki Mallian.** Feed: natural gas. Products: ammonia (210,000 mt/y), urea (345,000 mt/y).

**EXXON CHEMICAL PAKISTAN LTD.**

**Daharki, Dist. Sukkur.** Feed: natural gas. Products: ammonia (155,600 mt/y), urea (267,000 mt/y).

## PERU

**FERTILIZANTES SINTETICOS SA**

**Lima.** Feed: residual oil. Product: ammonia (75 mt/d).

**PETROPERU**

(Licensee of Witco Corp.—Concarb Div.)

**Negro de Humo plant, Talara.** Feed: heavy aromatic oil. Product: carbon black (15,000 mt/y).

**PETROPERU**

**Talara.** Feed: ammonia-carbon dioxide, FCC bottoms, isopropanol, propylene. Products: acetone (5,600 mt/y), carbon black (7,750 mt/y), isopropanol (11,400 mt/y), urea (510 mt/d).

## PHILIPPINES

**COLUMBIAN CARBON PHILIPPINES INC.**

**Bataan.** Feed: FCCU botton oil. Product: furnace carbon black (17,000 mt/y).

**LMG CHEMICALS INC.**

**San Pascual, Batangas.** Feed: benzene, dodecene. Product: alkylbenzene (24,800 mt/y).

## PORTUGAL

**COMPANHIA INDUSTRIAL DE RESINAS SINTETICAS (CIRES)**

**Estarreja.** Feed: vinyl chloride. Product: polyvinyl chloride (85,000 mt/y).

**COMPANHIA NACIONAL DE PETROQUÍMICA EP**

**Sines.** Feed: naphtha. Products: butadiene (40,000 mt/y), ethylene (300,000 mt/y), propylene (150,000 mt/y).

**EPSI—Empresa de Polímeros de Sines**

(86% Portuguese State, 13.2% Cdf Chimie)

**Sines.** Feed: ethylene, propylene. Products: polyethylene (180,000 mt/y), polypropylene (50,000 mt/y).

**PETROGAL**

**Leça da Palmeira.** Feed: reformate. Products: benzene (44,000 mt/y), orthoxylene (40,000 m/ty), paraxylene (90,000 mt/y), toluene (140,000 mt/y), xylene mix (10,000 mt/y).

**PETROQUÍMICA E GÁS DE PORTUGAL EP**

**Cabo Ruivo.** Feed: alcohol, naphtha, orthoxylene. Products: ammonia (90,000 mt/y), phthalic anhydride (15,000 mt/y), phthalates (20,000 mt/y).

**QUIMIGAL—Química de Portugal SA**

**Barreiro-Lavradio.** Feed: heavy fuel oil. Products: ammonia (290,000 mt/y), urea (80,000 mt/y).

## PUERTO RICO

**PHILLIPS PUERTO RICO INC.**

**Guayama.** Feed: naphtha. Products: benzene (411,000 mt/y), cyclohexane (296,000 mt/y), toluene (336,000 mt/y), orthoxylene (59,000 mt/y), paraxylene (213,000 mt/y).

## QATAR

**QATAR FERTILIZER CO.**

(75% Qatar General Petroleum Corp., 25% Norsk Hydro a.s.)

**Umm Said.** Feed: natural gas. Products: ammonia (725,000 mt/y), urea (780,000 mt/y).

**QATAR PETROCHEMICAL CO. LTD.**

(84% QPC, 16% ORKEM)

**Umm Said.** Feed: ethane. Products: butadiene (5,000 mt/y), ethylene (300,000 mt/y), ld polyethylene (175,000 mt/y), propylene (6,000 mt/y), pyrolysis gasoline (15,000 mt/y), sulfur (50,000 mt/y).

## SAUDI ARABIA

**AL-JUBAIL FERTILIZER CO.**

(Sabic with Taiwan Fertilizer Co.)

**Al-Jubail.** Feed: methane. Products: ammonia (300,000 mt/y),urea (600,000 mt/y).

**AL-JUBAIL PETROCHEMICAL CO.**

(50% Exxon Chemical Co.)

**Jubail Industrial City.** Feed: ethylene. Products: lld polyethylene, hd polyethylene (330,000 mt/y).

**ARABIAN PETROCHEMICAL CO.**

(100% Sabic)

**Al-Jubail.** Feed: ethane, styrene. Products: ethylene (650,000 mt/y), polystyrene (100,000 mt/y).

**EASTERN PETROCHEMICAL CO.**

(Sabic, Mitsubishi-led Japanese consortium)

**Al-Jubail.** Feed: ethylene. Products: ethylene glycol (330,000 mt/y), lldpe polyethylene (140,000 mt/y).

**IBN AL-BAYTAR NATIONAL CHEMICAL FERTILIZER CO.**

(50% SABIC & 50% SAFCO.)

**Al-Jubail.** Feed: methane. Product: ammonia (500,000 mt/y).

**IBN HAYYAN NATIONAL PLASTIC CO.**

**Al-Jubail.** Feed: ethylene, ethylene dichloride. Products: polyvinyl chloride (200,000 mt/y), vinyl chloride (300,000 mt/y).

**IBN-SINA NATIONAL METHANOL CO.**

(25% Celanese, 25% Texas Eastern)

**Al-Jubail.** Feed: methane. Product: methanol (770,000 mt/y).

**PETROMIN SHELL REFINING CO.**

(Shell 50%, Petromin 50%)

**Al Jubail.** Product: benzene (245,000 mt/y).

**IBN ZAHR SAUDI EUROPEAN PETROCHEMICAL CO.**

(70% SABIC & 30% Apicorp, Ecofuel and Neste Oy.)

**Al-Jubial.** Feed: methanol, butane. Product: methyl ter-butyl ether (500,000 mt/y).

**SAUDI ARABIAN FERTILIZER CO.**

(Sabic, Safco employees, private Saudi investors)

**Al-Dammam-Khobar Highway.** Feed: methane. Products: ammonia (200,000 mt/y), methanol (20,000 mt/y), urea (330,000 mt/y).

**SAUDI METHANOL CO.**

(Sabic, Mitsubishi-led Japanese consortium)

**Al-Jubail.** Feed: methane. Product: methanol (640,000 mt/y).

**SAUDI PETROCHEMICAL CO.**

(50% Pecten Arabian Co.—subsidiary of Shell Oil U.S.)

**Al-Jubail.** Feed: ethane. Products: ethanol (300,000 mt/y), ethylene (760,000 mt/y), ethylene dichloride (560,000 mt/y), styrene (360,000 mt/y).

**SAUDI YANBU PETROCHEMICAL CO.**

(50% Mobil Oil Corp.)

**Yanbu.** Feed: ethane. Products: ethylene (560,000 mt/y), ethylene glycol (250,000 mt/y), lld polyethylene (215,000 mt/y), hd polyethylene (215,000 mt/y).

## SINGAPORE

**ETHYLENE GLYCOLS SINGAPORE PTY. LTD.**

(50% Government, 30% Japanese interests, 20% Shell)

**Pulau Ayer Merbau.** Products: ethylene glycol (88,000 mt/y), ethylene oxide.

**PHILLIPS PETROLEUM SINGAPORE CHEMICALS LTD.**

(60% Phillips Petroleum International Corp., 25% Temasek Holdings Ltd., 10% Sumitomo Chemicals Co. Ltd., 5% Development Bank of Singapore Ltd.)

**Singapore.** Feed: ethylene. Product: hd polyethylene (170,000 mt/y).

**SHELL EASTERN PETROLEUM PTY. LTD.**
(100% Shell)
**Pulau Bukom.** Products: toluene, xylene mix, solvents.

## SOUTH AFRICA

**AECI LTD.**
**Midland, Sasolburg.** Feed: coal based acetylene, ethylene. Products: acetylene (59,000 mt/y), ethylene dichloride (80,000 mt/y), ld polyethylene (95,000 mt/y), lld polyethylene (100,000 mt/y), polyvinyl chloride (163,000 mt/y), solvents (22,000 mt/y), vinyl chloride (170,000 mt/y).
**Modderfontein.** Feed: coal. Products: ammonia (1,000 mt/d), methanol (50 mt/d).

**KARBOCHEM PTY. LTD.**
(division of Sentrachem)
**Newcastle.** Feed: butadiene, styrene. Products: polybutadiene (20,000 mt/y), SSBR (15,000 mt/y).
**Sasolburg.** Product: SBR (35,000 mt/y).

**KYNOCH FERTILIZER LTD.**
**Milnerton.** Feed: refinery gas. Product: ammonia (85,000 mt/y).

**NATIONAL CHEMICAL PRODUCTS LTD**
(division of Sentrachem)
**Germiston and Durban.** Feed: benzene, molasses, naphthalene, orthoxylene. Products: acetaldehyde (15,000 mt/y), acetic acid (12,000 mt/y), ethanol (45,000 mt/y), formaldehyde (22,000 mt/y), maleic anhydride (4,000 mt/y), phthalic anhydride (32,000 mt/y).

**SAFRIPOL PTY.**
(50% Hoechst, 50% Sentrachem)
**Sasolburg.** Feed: ethylene, propylene. Products: hd polyethylene (85,000 mt/y), polypropylene (44,000 mt/y).

**SASOL LTD.**
**Sasolburg and Secunda.** Feed: coal. Product: ethylene (345,000 mt/y), poly-grade propylene (150,000 mt/y), polypropylene (120,000 mt/y).

**SENTRACHEM SPECIALTIES DIVISION**
**Durban and Germiston.** Products: alkyds, polyester, polystyrene.

## SPAIN

**AISCONDEL SA**
**Monzón (Huesca).** Feed: acrylonitrile, butadiene, styrene, vinyl chloride monomer. Products: ABS-SAN (15,000 mt/y), polystyrene (10,000 mt/y), polyvinyl chloride (60,000 mt/y), expansible polystyrene (10,000 mt/y).
**Vilaseca (Tarragona).** Feed: ethylene, chlorine. Products: polyvinyl chloride (90,000 mt/y), vinyl chloride monomer (150,000 mt/y).

**ATOCHEM**
**Prat de Llobregat.** Feed: styrene. Product: ABS with compounds (8,000 mt/y), polystyrene with compounds (60,000 mt/y).

**BASF ESPANOLA SA**
(wholly owned by BASF)
**Tarragona.** Feed: acrylates, butadiene, naphtha, orthoxylene, propylene, styrene. Products: oxoalcohols-2ethylhexanol (65,000 mt/y), phthalic anhydride (16,500 mt/y), polypropylene (30,000 mt/y), polystyrene (41,500 mt/y), plasticizers (40,000 mt/y), solvents (8,000 mt/y), ABS, polyamide (9,800 mt/y).

**BORDEN ESPANA SA**
**Axpe-Erandio.** Feed: methanol. Product: formaldehyde (30,000 mt/y).

**BRILEN SA**
**Barbastro.** Feed: polyethylene terephthalate. Products: methanol (7,000 mt/y), polyester (25,000 mt/y).

**CALATRAVA SA**
**Puertollano.** Products: butadiene (32,000 mt/y), hd polyethylene (60,000 mt/y).
**Santander.** Products: carbon black (37,000 mt/y), SBR (82,000 mt/y).
**Tarragona.** Products: butadiene (100,000 mt/y), polyethylene (60,000 mt/y).

**CARBESA—Carbon Black Espanola SA**
(100% Repsol Quimica)
**Algeciras.** Feed: heavy aromatic oils. Product: carbon black (25,000 mt/y).

**CEPSA—Compañia Española de Petroleos SA**
**Luchana, Vizcaya.** Feed: alcohol, orthoxylene. Products: phthalic anhydride (16,000 mt/y), plasticizers (40,000 mt/y).
**San Roque, Cádiz .** Feed: naphtha. Products: aromatics mix (20,000 mt/y), benzene (80,000 mt/y), maleic anhydride (13,000 mt/y), orthoxylene (40,000 mt/y), paraxylene (34,000 mt/y), phthalic anhydride (20,000 mt/y), propylene (60,000 mt/y), toluene (130,000 mt/y), xylene mix (120,000 mt/y), solvents (90,000 mt/y).

**DOW CHEMICAL IBERICA SA**
**Bilbao.** Products: polystyrene, SB-latex.
**Tarragona.** Products: benzene, ethylene, hd-ld-lld polyethylene, propylene.

**ENFERSA—Empresa Nacional de Fertilizantes SA**
**Cartagena, Murcia.** Feed: natural gas. Products: ammonia (240,000 mt/y), urea (145,000 mt/y).
**Puertollano, Ciudad Real.** Feed: naphtha. Products: ammonia (180,000 mt/y), urea (125,000 mt/y).

**ERTOIL SA.**
**La Rabida, Huelva.** Feed: naphtha. Products: benzene (130,000 mt/y), cyclohexane (80,000 mt/y).

**HINDUSTRIAL SA**
**Martorell.** Feed: vcm. Product: polyvinyl chloride.

**INDUSTRIAS QUIMICAS ASOCIADOS SA.**
(100% Shell)
**Tarragona.** Feed: olefins. Products: acetone (8,000 mt/y), ethylene glycol (60,000 mt/y), ethylene oxide (100,000 mt/y), isopropanol (35,000 mt/y).

**INTERQUISA—Intercontinental Quimica SA**
(50% Cepsa, 50% Amoco International)
**San Roque.** Feed: methanol, paraxylene. Products: dimethyl terephthalate (100,000 mt/y), terephthalic acid (180,000 mt/y).

**PAULAR SA**
**Morell, Tarragona.** Products: acrylonitrile (90,000 mt/y), methyl methacrylate (30,000 mt/y).

**PETROQUIMICA ESPANOLA SA**
(100 % Cepsa)
**San Roque (Cádiz).** Feed: benzene, kerosine, sulfur. Product: alkylbenzene (180,000 mt/y).

**PRODUCTOS QUIMICOS DEL MEDITERRÁNEO SA**
**El Grao, Castellon de la Plana.** Feed: cyclohexane. Product: caprolactam (45,000 mt/y).

**REPSOL PETROLEO SA**
**La Coruña.** Feed: isobutylene, methanol. Products: MTBE (32,000 mt/y), propylene (50,000 mt/y).
**Puertollano.** Feed: naphtha, refinery gases. Products: benzene (90,000 mt/y), ethylene (240,000 mt/y), propylene (180,000 mt/y).
**Tarragona.** Feed: isobutylene, LPG, methanol, naphtha. Products: ethylene (390,000 mt/y), MTBE (52,000 mt/y), propylene (180,000 mt/y).

**REPSOL QUIMICA SA**
**Puertollano.** Feed: olefins cracker. Products: butadiene (32,000 mt/y), ld-lld-hd polyethylene (215,000 mt/y), polyols (30,000 mt/y), polypropylene (80,000 mt/y), propylene glycol (15,000 mt/y), propylene oxide (50,000 mt/y), styrene 110,000 mt/y), ethylbenzene (140,000 mt/y).
**Santander.** Feed: butadiene, styrene. Products: carbon black (40,000 mt/y), SBR-PB (80,000 mt/y).
**Tarragona.** Feed: olefins cracker. Products: acrylonitrile (90,000 mt/y), butadiene (100,000 mt/y), ld-hd polyethylene (245,000 mt/y), polypropylene (50,000 mt/y).

**RESISA—Resinas Sintéticas SA**
**San Celoni, Barcelona.** Feed: maleic anhydride, phthalic anhydride, paraxylene, solvents. Products: polyester (17,000 mt/y), resins: (alkyd 13,000 mt/y, phenolic 2,000 mt/y, acrylic 1,000 mt/y, p.e.t. 4,000 mt/y).

**RIO RODANO SA**
**Guturribay, Vizcaya.** Feed: butadiene, styrene. Product: SBR latex (12,000 mt/y).
**Hernani, Guipúzcoa.** Feed: chlorine, normal paraffins, vinyl chloride monomer. Products: polyvinyl chloride (30,000 mt/y), plasticizers (3,000 mt/y).
**Miranda de Ebro, Burgos.** Feed: glycols, maleic anhydride, oxoalcohols, orthoxylene, vinyl chloride monomer. Products: phthalic anhydride (30,000 mt/y), polyester (22,000 mt/y), polyvinyl chloride (75,000 mt/y), plasticizers (18,000 mt/y).

**TARRAGONA QUIMICA SA**
(100% Hoechst)
**Tarragona.** Feed: olefins. Products: hd polyethylene (100,000 mt/y), polypropylene (90,000 mt/y), vinyl acetate (75,000 mt/y).

**VINICLOR SA**
**Martorell, Barcelona.** Feed: ethylene. Product: vinyl chloride (240,000 mt/y).

## SRI LANKA

**STATE FERTILIZER MANUFACTURING CORP.**
**Sapugaskanda.** Feed: naphtha. Products: ammonia (86,476 mt/y), urea (138,458 mt/y).

## SUDAN

**SUDAN-REN CHEMICALS & FERTILIZER LTD.**
**Khartoum.** Feed: naphtha. Product: ammonia (175 mt/d).

## SWEDEN

**DEGUSSA**
**Malmoe.** Feed: aromatic hydrocarbons, coal tar oil. Product: carbon black.

**DOW CHEMICAL**
**Norrkoeping.** Product: SB-latex.

**NESTE OXO AB**
**Nol.** Feed: orthoxylene. Product: phthalic anhydride (25,000 mt/y).
**Ornskoldsvik.** Feed: butyraldehyde. Product: butanol (40,000 mt/y).
**Stenungsund.** Feed: phthalic anhydrice, propylene. Products: butanol (40,000 mt/y), butyraldehyde (165,000 mt/y), oxoalcohols (100,000 mt/y), phthalic anhydride (25,000 mt/y).

**NESTE POLYESTER AB**
**Nol.** Product: polyester (20,000 mt/y).

**NESTE POLYETEN AB**
**Stenungsund.** Feed: ethylene. Product: ld-hd-md-lld polyethylene (440,000 mt/y).

**NORSK HYDRO PLAST AB**
**Stenungsund.** Feed: ethylene. Products: polyvinyl chloride (120,000 mt/y), vinyl chloride (110,000 mt/y), ethylene dichloride (180,000).

**PERSTORP AB**
**Perstorp.** Feed: methanol. Products: formaldehyde (200,000 mt/y), polyols, resins.

**STATOIL PETROKEMI AB.**

**Stenungsund.** Feed: naphtha, propane. Products: ethylene (370,000 mt/y), fuel oils (40,000 mt/y), propylene (180,000 mt/y), pyrolysis gasoline (130,000 mt/y).

**SVENSKA POLYSTYREN FABRIKEN AB**

**Trelleborg.** Feed: styrene. Product: polystyrene (60,000 mt/y).

## SWITZERLAND

**EVC**

(50% ICI, 50% Enichem)

**Sins.** Product: polyvinyl chloride (45,000 mt/y).

**LONZA AG**

**Visp.** Feed: LVN-LPG. Products: acetaldehyde, acetic acid, acetic anhydride, acetylene (15,000 mt/y), ammonia (40,000 mt/y), aniline (3,000 mt/y), ethylene (30,000 mt/y), formaldehyde.

## SYRIA

**GENERAL FERTILIZER CO.**

**Katteneh-Homs.** Feed: natural gas. Products: ammonia (250,000 mt/y), ethylene (250,000 mt/y), urea (250,000 mt/y).

## TRINIDAD

**FEDERATION CHEMICALS LTD.**

(subsidiary of W.R. Grace & Co.)

**Point Lisas.** Feed: natural gas. Product: ammonia (231,300 mt/y).

**FERTILIZERS OF TRINIDAD & TOBAGO LTD.**

**Point Lisas.** Feed: anhydrous ammonia. Product: ammonia (780,000 mt/y).

**TRINIDAD NITROGEN**

(49% W. R. Grace & Co., and Government of Trinidad-Tobago)

**Point Lisas.** Feed: natural gas. Product: ammonia (816,462 mt/y).

## TURKEY

**ALPET—Aliaga Petrokimya San Ve Tic AS**

**Aliaga.** Feed: naphtha. Products: acrylonitrile (70,000 mt/y), benzene (124,000 mt/y), butadiene (80,000 mt/y), ethylene (300,000 mt/y), ethylene dichloride (165,000 mt/y), ethylene glycol (68,000 mt/y), orthoxylene (65,000 mt/y), paraxylene (132,000 mt/y), phthalic anhydride (30,000 mt/y), ld polyethylene (150,000 mt/y), hd polyethylene (40,000 mt/y), polypropylene (60,000 mt/y), polyvinyl chloride (100,000 mt/y), propylene (138,000 mt/y), terephthalic acid (70,000 mt/y), toluene (40,000 mt/y), vinyl chloride (105,000 mt/y).

**BASF-SUMERBANK TURK KIMYA SANAYII AS**

**Gebze.** Feed: methanol. Product: formaldehyde (32,000 mt/y).

**SASA ARTIFICIAL & SYNTHETIC FIBERS INC.**

**Adana.** Feed: methanol, monoethylene glycol, paraxylene. Products: dimethyl terephthalate (80,000 mt/y), polyester (100,000 mt/y).

**YARPET—Yarimca Petrokimya**

**Yarimca-Izmit.** Feed: naphtha, NaCl, aromatic oil, benzene, $C_4$, ammonia, sulfur. Products: alkylbenzene (20,000 mt/y), butadiene (33,000 mt/y), caprolactam (25,000 mt/y), carbon black (30,000 mt/y), ethylene (55,000 mt/y), fuel oils (6,850 mt/y), polybutadiene (13,500 mt/y), ld polyethylene (24,300 mt/y), polystyrene (15,000 mt/y), polyvinyl chloride (46,800 mt/y), propylene (39,600 mt/y), pyrolysis gasoline (60,000 mt/y), styrene (19,450 mt/y), vinyl chloride (48,600 mt/y), SBR (32,150 mt/y).

## UNITED KINGDOM

**ATOCHEM**

**Stalybridge.** Product: polystyrene with compounds (80,000 mt/y).

**BORDEN (U.K.) LTD.**

**Peterlee.** Feed: methanol. Products: formaldehyde (40,000 mt/y), resins.

**Southampton.** Feed: methanol. Product: formaldehyde (25,000 mt/y).

**BP CHEMICALS LTD.**

**Baglan Bay.** Products: benzene concentrate (150,000 mt/y), butadiene (60,000 mt/y), ethanol (155,000 mt/y), ethylene (350,000 mt/y), isopropanol (85,000 mt/y), propylene (200,000 mt/y), styrene (275,000 mt/y), toluene (6,000 mt/y), vinyl acetate (85,000 mt/y).

**Carshalton.** Product: solvents and plasticizers (15,000 mt/y).

**Barry.** Product: resins (40,000 mt/y).

**Grangemouth.** Products: acetone (25,000 mt/y), acrylonitrile (70,000 mt/y), benzene (250,000 mt/y), butadiene (48,000 mt/y), ethanol (155,000 mt/y), ethylene (270,000 mt/y), polybutylenes (50,000 mt/y), hd polyethylene (150,000 mt/y), ld polyethylene (90,000 mt/y), propylene (180,000 mt/y).

**Hull.** Products: acetic acid (400,000 mt/y), acetic anhydride (175,000 mt/y), acetone (46,000 mt/y), ethanol (25,000 mt/y), phthalic anhydride (70,000 mt/y).

**Wilton.** Products: butadiene (90,000 mt/y), ethylene (350,000 mt/y), ld polyethylene (85,000 mt/y), propylene (60,000 mt/y).

**CIBA-GEIGY LTD.**

**Duxford, Cambridge.** Feed: methanol. Product: formaldehyde (120,000 mt/y).

**CONOCO LTD.**

**South Killingholme, Humberside.** Feed: reformate. Product: benzene (110,000 mt/y).

**DOW CHEMICAL**

**Barry.** Product: polystyrene.

**ENICHEM ELASTOMERS LTD.**

**Grangemouth, Scotland.** Feed: butadiene, styrene, ethylene, propylene. Products: polybutadiene (45,000 mt/y), polypropylene (5,000 mt/y), SBR (30,000 mt/y), block-SBR (15,000 m/ty), ethylene-propylene rubber (15,000 mt/y).

**Hythe, Hampshire.** Feed: acrylonitrile, butadiene, ethylbenzene. Product: rubber (150,000 mt/y).

**EXXON CHEMICAL LTD.**

**Fawley.** Feed: petroleum fractions. Products: higher olefins (230,000 mt/y), butyl-halobutyl rubber (60,000 mt/y).

**EXXON CHEMICAL OLEFINS INC.**

**Fawley.** Feed: petroleum fractions. Products: butadiene (30,000 mt/y), ethylene (105,000 mt/y), isobutylene (65,000 mt/y), propylene (100,000 mt/y).

**Mossmorran, Fife.** Feed: ethane. Product: ethylene (650,000 mt/y).

**IMPERIAL CHEMICAL INDUSTRIES LTD.**

Polymers Group

**Billingham.** Products: ammonia, methanol (500,000 mt/y), oxoalcohols (250,000 mt/y), phenol (80,000 mt/y).

**North Tees.** Products: benzene (525,000 mt/y), cumene (135,000 mt/y), cyclohexane (300,000 mt/y), toluene (330,000 mt/y), xylene mix (330,000 mt/y), ethlbenzene (45,000 mt/y).

**Wilton.** (80% ICI—20% BP): Feed: naphtha, propane. Products: butadiene (100,000 mt/y), ethylene (775,000 mt/y), propylene (350,000 mt/y), ethylene dichloride (250,000 mt/y), ethylene glycol (85,000 mt/y), ethylene oxide (240,000 mt/y), formaldehyde, paraxylene (340,000 mt/y), polyester (90,000 mt/y), polypropylene (150,000 mt/y), terephthalic acid (550,000), polyamide (240,000 mt/y).

**IMPERIAL CHEMICAL INDUSTRIES LTD.**

**Barry.** Product: polyvinyl chloride (90,000 mt/y).

**Caster-Kellner, Runcorn.** Product: vinyl chloride monomer (180,000 mt/y), ethylene dichloride (450,000 mt/y).

**Hillhouse, Lancashire.** Product: vinyl chloride (180,000 mt/y).

**KEMIRA INCE LTD.**

**Ince.** Feed: natural gas. Product: ammonia (550,000 mt/y).

**KEMIRA LTD.**

**Hull.** Feed: hydrogen. Product: ammonia (230,000 mt/y).

**NORSK HYDRO POLYMERS LTD.**

**Aycliffe.** Feed: vinyl chloride. Product: polyvinyl chloride (130,000 mt/y).

**SEVALCO LTD.**

(50% Columbian Chemicals, 50% Phillips Petroleum)

**Avonmouth, Bristol.** Feed: heavy aromatic oils. Product: furnace and thermal carbon black (70,000 mt/y).

**SHELL CHEMICALS U.K. LTD.**

**Carrington.** Feed: ethylene, ethylene oxide, propylene, propylene oxide, styrene. Products: alcohol ethoxylates (60,000 mt/y), ld polyethylene (105,000 mt/y), polypropylene (110,000 mt/y), polystyrene (50,000 mt/y).

**Shell Haven.** Feed: benzene. Product: linear alkylbenzene (120,000 mt/y).

**Stanlow.** Feed: refinery gases. Products: acetone (40,000 mt/y), benzene (450,000 mt/y), butanol (30,000 mt/y), isopropanol (100,000 mt/y), propylene (70,000 mt/y), higher olefins (220,000 mt/y), solvents.

**UKF FERTILIZERS LTD.**

**Ince, Chester.** Feed: natural gas. Product: ammonia (325,000 mt/y).

## UNITED STATES

**AGRICULTURAL MINERALS CORP.**

(one of the Williams Companies)

**Blytheville, Ark.** Feed: natural gas. Products: ammonia (950 mt/d), urea (950 mt/d).

**Donaldsonville, La.** Feed: natural gas. Products: ammonia (410,000 mt/y), urea (205,000 mt/y).

**Verdigris, Okla.** Feed: natural gas. Products: ammonia (2,300 mt/d), urea ammonium nitrate solution (1,000 mt/d)

**AIR PRODUCTS AND CHEMICALS INC.**

**Calvert City, Ky.** Feed: vinyl acetate, vinyl chloride. Products: acetic acid (54,545 mt/y), polyvinyl alcohol (52,272 mt/y), polyvinyl chloride (136,116 mt/y).

**New Orleans, La.** Feed: natural gas. Product: ammonia (280,000 mt/y).

**Pensacola, Fla.** Feed: ammonia, natural gas, vinyl chloride. Products: ammonia (94,000 mt/y), methanol (180,000 mt/y), polyvinyl chloride (90,700 mt/y), urea (28,000 mt/y).

**ALLIED-SIGNAL INC.**

**Baton Rouge, La.** Product: hd polyethylene (521,629 mt/y).

**Chesterfield, Va. and Columbia, S.C.** Product: nylons (276,781 mt/y).

**Geismar, La.** Product: HF (85,754 mt/y).

**Hopewell, Va.** Product: ammonia (364,686 mt/y), caprolactam (290,000 mt/y).

**Moncure, N.C.** Product: polyester (50,802 mt/y).

**Philadelphia, Pa.** Products: acetone (225,000 mt/y), phenol (365,000 mt/y).

**AMERICAN CYANAMID CO.**

**Fortier, La.** Feed: natural gas, propylene. Products: acrylonitrile (160,000 mt/y), ammonia (425,000 mt/y).

**AMOCO CHEMICAL CO.**

**Cedar Bayou, Tex.** Feed: propylene. Product: polypropylene (226,800 mt/y).

**Chocolate Bayou, Tex.** Feed: ethane, ethylene, naphtha, propane, propylene. Products: aromatics (82,000 mt/y), butadiene (81,600 mt/y), ethylene (1,081,400 mt/y), polypropylene (372,800 mt/y), propylene (415,000 mt/y).

**Cooper River, S.C.** Feed: paraxylene. Product: terephthalic acid (728,000 mt/y).

**Decatur, Ala.** Feed: paraxylene, xylene. Products: paraxylene (453,600 mt/y), terephthalic acid (884,500 mt/y).

**Joliet, Ill.** Feed: butane, metaxylene, styrene. Products: isophthalic acid (79,400 mt/y), maleic anhydride (39,000 mt/y), polystyrene (94,300 mt/y), trimellitic anhydride (47,600 mt/y).

**Texas City, Tex.** Feed: aromatics, benzene, butylenes, ethylene, propylene, xylene. Products: metaxylene (102,000 mt/y), paraxylene (625,500 mt/y), polyalphamethyl styrene (13,600 mt/y), polyisobutylene (88,500 mt/y), propylene (303,500 mt/y), solvents (161,500 mt/y), styrene (353,300 mt/y).

**Torrance, Calif.** Feed: styrene. Product: polystyrene (14,000 mt/y).

**Whiting, Ind.** Feed: butylenes, methanol. Product: MTBE (162,800 mt/y), polyisobutylene (74,800 mt/y).

**Willow Springs, Ill.** Feed: styrene. Products: polystyrene (34,000 mt/y).

### AMOCO OIL CO.

**Texas City, Tex.** Feed: crude oil. Products: benzene (460,000 mt/y), toluene (910,000 mt/y), xylene mix (760,000 mt/y).

**Whiting, Ind.** Feed: crude oil. Products: propylene (170,000 mt/y), xylene mix (646,000 mt/y).

### ARCO CHEMICAL CO.

**Bayport, Tex.** Feed: isobutane, propylene. Products: butyl alcohol (1,444,000 mt/y), isobutylene (185,000 mt/y), propylene glycol (216,000 mt/y), propylene oxide (606,500 mt/y).

**Channelview, Tex.** Products: ethylbenzene (917,000 mt/y), MTBE (27,500 b/d), polyols (85,000 mt/y), propylene oxide (300,000 mt/y), styrene monomer (700,000 mt/y).

**Monaca, Pa.** Feed: styrene. Products: polystyrene (237,500 mt/y), styrene monomer (105,000 mt/y).

### ARISTECH CHEMICAL CORP.

**Florence, Kentucky.** Feed: methyl metacrylate. Product: acrylics (17,237 mt/y).

**Haverhill, Ohio.** Feed: ammonia, cumene. Products: acetone (178,717 mt/y), bisphenol A (97,523 mt/y), phenol (285,766 mt/y).

**LaPorte, Tex.** Feed: propylene. Product: polypropylene (172,367 mt/y).

**Neal, West Va.** Feed: propylene. Product: polypropylene (140,615 mt/y).

**Neville Island, Pa.** Feed: alcohols, dibasic acids. Products: maleic anhydride (19,051 mt/y), plasticizers (95,255 mt/y).

**Neville Island, Pa., Jacksonville, Ark., Colton, Calif., Bartow, Fla.** Feed: dibasic acids, alcohols, glycols, styrene. Product: polyester (104,327 mt/y).

**Pasadena, Tex.** Feed: orthoxylene, propylene/natural gas. Product: phthalic annydride (95,255 mt/y), 2-ethylhexanol (86,183 mt/y).

### ASHLAND CHEMICAL CO.

**Catlettsburg, Ky.** Feed: crude oil, coal tar light oil. Products: aromatics mix (10,900 mt/y), benzene (160,000 mt/y), cumene (238,000 mt/y), toluene (110,000 mt/y), xylene mix (90,000 mt/y).

**Neal, W. Va.** Feed: n-butane. Product: maleic anhydride (29,492 mt/y).

**Plaquemine, La.** Feed: natural gas. Product: methanol (390,000 mt/y).

### ATLAS POWDER CO.

(subsidiary of Tyler Corp.)

**Joplin, Mo**. Feed: natural gas. Products: ammonia (355 mt/d), urea (195 mt/d).

### BASF CORP.

**Chemicals Division.**

**Freeport, Tex.** Products: acrylic-acrylates (280 mt/y), butanol-ethylhexanol (100 mt/y), caprolactam (159 mt/y).

**Geismar, La.** Products: ethylene glycol (177 mt/y), ethylene oxide (218 mt/y), ethylene (230,000 mt/y).

**South Brunswick, N.J.** Product: expandable polystyrene (80 mt/y).

**S. Kearny, N.J.** Products: phthalic anhydride (80 mt/y), plasticizers (109 mt/y).

**Various location:** Products: nylons (223 mt/y), polyester (18 mt/y).

### BISON NITROGEN PRODUCTS CO.

(65% Terra International, 35% W. R. Grace).

**Woodward, Okla.** Feed: ammonia, carbon dioxide. Product: urea (305 mt/d).

### BORDEN CHEMICAL CO.

Chemical Division

**Demopolis, Ala.** Feed: methanol. Product: formaldehyde (36,000 mt/y).

**Diboll, Tex.** Feed: methanol. Product: formaldehyde (57,000 mt/y).

**Fayetteville, N.C.** Feed: methanol. Product: formaldehyde (193,000 mt/y).

**Fremont, Calif.** Feed: methanol. Product: formaldehyde (80,000 mt/y).

**Kent, Wash.** Feed: methanol. Product: formaldehyde (43,000 mt/y).

**La Grande, Ore.** Feed: methanol. Product: formaldehyde (33,000 mt/y).

**Louisville, Ky.** Feed: methanol. Product: formaldehyde (52,000 mt/y).

**Missoula, Mont.** Feed: methanol. Product: formaldehyde (62,000 mt/y).

**Sheboygan, Wisc.** Feed: methanol. Product: formaldehyde (78,000 mt/y).

**Springfield, Ore.** Feed: methanol. Product: formaldehyde (138,000 mt/y).

**Vicksburg, Miss.** Feed: methanol. Product: formaldehyde (32,000 mt/y).

### BORDEN CHEMICALS-PLASTICS OPERATING LTD. PARTNERSHIP

**Geismar, La.** Feed: natural gas, ethylene, chlorine. Products: acetic acid (63,000 mt/y), acetylene (90,000 mt/y), ammonia (360,000 mt/y), formaldehyde (170,000 mt/y), methanol (690,000 mt/y), polyvinyl chloride (180,000 mt/y), urea (205,000 mt/y), vinyl chloride (370,000 mt/y).

**Illiopolis, Ill.** Feed: vinyl chloride, vinyl acetate. Product: polyvinyl chloride (145,000 mt/y).

### BORG-WARNER CHEMICALS

**North American plants.** Product: ABS (362,874 mt/y).

**Carville, La.** (with Cosden Oil & Chemical). Feed: benzene, ethylene. Products: styrene (340,195 mt/y), toluene (17,000 mt/y).

**Geismar, La.** (with Union Texas Petroleum and BASF). Feed: ethane, propane. Products: butadiene (2,722 mt/y), ethylene (54,431 mt/y), propylene (2,558 mt/y). Note: Borg-Warner share only.

### BP CHEMICALS AMERICA

**Green Lake, Tex.** Feed: ammonia, propylene. Product: acrylonitrile (270,000 mt/y).

**Lima, Ohio.** Feed: ammonia, natural gas, propylene. Products: acrylonitrile (160,000 mt/y), ammonia (500,000 mt/y), urea (400,000 mt/y).

### BP OIL CO.

**Belle Chase, La.** Feed: reformate, toluene. Products: benzene (250,000 mt/y), xylene mix (315,000 mt/y).

**Lima, Ohio.** Feed: refinery gases, reformate, toluene. Products: benzene (330,000 mt/y), toluene (315,000 mt/y).

### CABOT CORP.

**Pampa, Tex.; Franklin and Ville Platte, La.; and Waverly, W. Va.** Feed: gas and petroleum fractions. Product: carbon blacks (furnace process and thermal) (440,000 mt/y).

### CAIN CHEMICAL INC.

(subsidiary of OxyChem)

**Bayport, Tex.** Feed: ethylene. Products: ethylene glycol (220,000 mt/y), ethylene oxide (235,000 mt/y), ethylene derivatives (70,000 mt/y).

**Beaumont, Tex.** Feed: ethylene. Products: ethylene glycol (290,000 mt/y), ethylene oxide (210,000 mt/y).

**Chocolate Bayou, Tex.** Feed: gas oil, drip oil, ethane, naphtha, toluene. Products: aromatics (340,000 mt/y), butadiene (60,000 mt/y), ethylene (500,000 mt/y), propylene (305,000 mt/y).

**Corpus Christi, Tex.** Feed: ethane, gas oil, naphtha, propane, toluene. Products: aromatics (250,000 mt/y), butadiene (95,000 mt/y), ethylene (770,000 mt/y), propylene (275,000 mt/y).

**Lake Charles, La.** Feed: ethane, propane. Products: butadiene (20,000 mt/y), ethylene (250,000 mt/y), propylene (85,000 mt/y).

**Matagorda, Tex.** Feed: ethylene. Product: hd polyethylene (295,000 mt/y).

**Orange, Tex.** Feed: ethylene. Product: hd polyethylene (120,000 mt/y).

**Victoria, Tex.** Feed: ethylene. Product: hd polyethylene (204,000 mt/y).

### CAPE INDUSTRIES

(joint venture Hoechst-Celanese and American Petrofina).

**Wilmington, N.C.** Feed: methanol, paraxylene. Products: dimethyl terephthalate (640,000 mt/y), terephthalic acid (140,000 mt/y).

### CERTAINTEED CORP.

**Lake Charles, La.** Feed: vinyl chloride monomer. Product: polyvinyl chloride (107,000 mt/y).

### CF INDUSTRIES INC.

**Donaldsonville, La.** Feed: natural gas. Products: ammonia (1,570,000 mt/y), urea (980,000 mt/y).

**Terre Haute, Ind.** Feed: natural gas. Product: ammonia (130,000 mt/y).

### CHAMPLIN REFINING CO.

**Corpus Christi, Tex.** Feed: crude oil. Products: benzene (165,000 mt/y), cumene (374,000 mt/y), cyclohexane (113,000 mt/y), propylene (68,000 mt/y), toluene (53,000 mt/y).

### CHEVRON CHEMICAL CO.

(subsidiary of Standard Oil Co. of California)

**Baytown, Tex.** Feed: ethylene. Products: alphaolefins (113,600 mt/y), ethylene (544,300 mt/y), butadiene (190,000 mt/y), ld polyethylene (272,000 mt/y), propylene (295,000 mt/y).

**Cedar Bayou, Tex.** Feed: LNG, naphtha. Product: propylene (357,000 mt/y).

**Finley, Wash.** Feed: natural gas. Product: ammonia (125,000 mt/y).

**Marietta, Ohio.** Feed: styrene. Product: polystyrene (217,000 mt/y).

**Orange, Tex.** Feed: ethylene. Product: ld polyethylene (136,000 mt/y), hd polyethylene (261,700 mt/y).

**Pascagoula, Miss.** Feed: petroleum base stocks. Product: paraxylene (238,000 mt/y).

**Philadelphia, Pa.** Feed: petroleum base stocks. Products: benzene (127,000 mt/y), cumene (204,000 mt/y), toluene (102,000 mt/y).

**Port Arthur, Tex.** Feed: petroleum base stocks. Products: benzene (487,000 mt/y), butadiene (22,000 mt/y), cumene (408,000 mt/y), cyclohexane (112,000 mt/y), ethylene (385,000 mt/y), propylene (204,000 mt/y), toluene (234,000 mt/y).

**St. Helens, Ore.** Feed: natural gas. Products: ammonia (75,000 mt/y), urea (105,000 mt/y).

**St. James, La.** Feed: ethylene. Product: styrene (293,000 mt/y).

### CITGO PETROLEUM CORP.

**Lake Charles, La.** Feed: crude. Product: propylene (119,400 mt/y).

### COASTAL EAGLE POINT OIL CO.

**Westville, N.J.** Feed: crude oil. Product: cumene (94,000 mt/y).

### COASTAL REFINING AND MARKETING INC.

Products: benzene (246,000 mt/y), xylene mix (77,000 mt/y).

### COLUMBIA NITROGEN CORP.

**Augusta, Ga.** Feed: natural gas. Products: ammonia (500,000 mt/y), urea (360,000 mt/y).

### COLUMBIAN CHEMICALS CO.

**El Dorado, Ark., Franklin, La., Mojave, Calif., Moundsville, W. Va., Ulysses, Kans.** Feed: heavy aromatic hydrocarbons. Product: carbon black (293,000 mt/y).

### COMINCO AMERICAN INC.

**Borger, Tex.** Feed: natural gas. Products: ammonia (325,000 mt/y), urea (71,500 mt/y).

### CONCARB DIVISION, WITCO CORP.

**Phenix City, Ala.** Feed: heavy aromatic oil. Product: carbon black (27,215 mt/y).

**Ponca City, Okla.** Feed: heavy aromatic oil. Product: carbon black (68,000 mt/y).

**Sunray, Tex.** Feed: heavy aromatic oil. Product: carbon black (54,000 mt/y).

### COPOLYMER RUBBER & CHEMICAL CORP.

**Addis, La.** Feed: petroleum derivative. Product: ethylene-propylene rubber (40,000 mt/y).

**Baton Rouge, La.** Feed: petroleum derivatives. Products: styrene-butadiene rubber (190,000 mt/y).

### DEGUSSA.

**Aransas Pass, Tex.** Product: carbon black (50,000 mt/y).

**Belpre, Ohio.** Product: carbon black (55,000 mt/y).

**Ivanhoe, La.** Product: carbon black (100,000 mt/y).

**Mobile, Ala.** Product: (24,000 mt/y).

### DIAMOND SHAMROCK REFINING & MARKETING CO.

**Sunray, Tex.** Feed: natural gas. Product: ammonia (400 mt/d).

### DIXIE CHEMICAL CO.

**Bayport, Tex.** Feed: acrylic monomers. Product: acrylics (5,000 mt/y).

### DOW CHEMICAL

**Freeport, Tex.** Products: acetyiene (4,000 mt/y), acrylonitrile-butadiene-styrene (136,000 mt/y), ammonia (47,000 mt/y), benzene (535,000 mt/y), bisphenol A (77,000 mt/y), ethylbenzene (795,000 mt/y), ethylene (1,820,000 mt/y), ethyl chloride (35,000 mt/y), ethylene dichloride (727,000 mt/y), ethylene glycol (115,000 mt/y), ethylene oxide (130,000 mt/y), phenol (211,000 mt/y), hd polyethylene (75,000 mt/y), ld polyethylene (400,000 mt/y), propylene (250,000 mt/y), propylene glycol (114,000 mt/y), propylene oxide (435,000 mt/y), styrene (590,000 mt/y).

**Ironton, Ohio.** Products: acrylonitrile (29,000 mt/y), polystyrene.

**Oyster Creek (Freeport), Tex.** Products: acetone (127,000 mt/y), ethylene dichloride (500,000 mt/y), vinyl chloride (350,000 mt/y).

**Plaquemine, La.** Products: ethylene (682,000 mt/y), ethylene dichloride (900,000 mt/y), ethylene glycol (204,000 mt/y), ethylene oxide (206,000 mt/y), hd polyethylene (120,000 mt/y), ld polyethylene (350,000 mt/y), propylene (75,000 mt/y), propylene glycol (68,000 mt/y), propylene oxide (200,000 mt/y), plasticizers (54,000 mt/y).

**Torrance, Calif.** Products: acrylonitrile (34,000 mt/y), polystyrene (453,000 mt/y).

### DSM CHEMICALS NORTH AMERICA, INC.

**Augusta, GA.** Feed: cyclohxane. Product: caprolactam (160,000 mt/y).

### ETHYL CORP.

**Orangeburg, S.C.** Feed: ethylene. Product: alkylbenzene.

**Pasadena, Tex.** Feed: ethylene. Products: alphaolefins, ethylchloride, ethylene dichloride.

### EXXON CHEMICAL AMERICAS

**Baton Rouge, La.** Feed: petroleum intermediates. Products: benzene, butadiene, butylenes, carbon black feedstocks, ethylene, ethylene vinyl acetate copolymers, heart cut distillates, higher olefins, isoparaffins, isoprene, isopropanol, oxoalcohols, phthalic anhydride, ld polyethylene, propylene, vinyl acetate, plasticizers, resins, butyl rubber, chlorobutyl, ep rubber, solvents.

**Baytown, Tex.** Feed: petroleum intermediates. Products: benzene, butadiene, butene 1, ethylene, isoamylene, isobutylene, MTBE, orthoxylene, paraffins, paraxylene, polybutene polymers, polypropylene, polyisobutylene, propylene, butyl rubber.

**Bayway, N.J.** Feed: petroleum intermediates. Products: polyisobutylene, propylene, solvents.

**Mont Belvieu, Tex.** Products: linear ld polyethylene, hd polyethylene.

### FARMLAND INDUSTRIES INC.

**Beatrice, Neb.** Feed: natural gas. Product: ammonia (590 mt/d).

**Dodge City, Kan.** Feed: natural gas. Product: ammonia (590 mt/d).

**Enid, Okla.** Feed: natural gas. Products: ammonia (2,280 mt/d), urea (900 mt/d).

**Fort Dodge, Iowa.** Feed: natural gas. Product: ammonia (570 mt/d).

**Lawrence, Kan.** Feed: natural gas. Products: ammonia (1,040 mt/d), urea (680 mt/d).

**Pollock, La.** Feed: natural gas. Product: ammonia (1,140 mt/d).

### FINA OIL & CHEMICAL CO.

**Big Spring, Tex.** Feed: crude oil. Products: benzene (25,000 mt/y),propylene (30,000 mt/y).

**Calumet City, Ill.** Feed: styrene. Product: polystyrene (90,718 mt/y).

**Carville, La.** Feed: benzene, ethylene. Products: polystyrene (155,000 mt/y), styrene (340,300 mt/y).

**LaPorte, Tex.** Feed: ethylene, propylene. Product: polypropylene (408,234 mt/y).

**Port Arthur, Tex.** Feed: crude oil. Products: benzene (171,000 mt/y), propylene (55,000 mt/y), xylene mix (295,000 mt/y).

### FIRESTONE SYNTHETIC RUBBER & LATEX CO.

**Lake Charles, La.** Feed: butadiene, styrene. Product: SBR (120,000 mt/y).

**Orange, Tex.** Feed: duradene. Product: polybutadiene (110,000 mt/y).

### GENCORP POLYMER PRODUCTS.

**Mogadore, Ohio.** Feed: butadiene, styrene, vinyl pyridine, vinylidene chloride. Product: SBR (93,000 mt/y).

### GENERAL TIRE INC.

(A GenCorp Co.)

**Odessa, Tex.** Feed: butadiene, styrene. Product: SBR (108,000 mt/y).

### GEORGIA GULF CORP.

**Delaware City, Del.** Feed: vinyl chloride. Product: polyvinyl chloride (68,000 mt/y).

**Pasadena, Tex.** Feed: benzene, propylene. Product: cumene (635,036 mt/y).

**Plaquemine, La.** Feed: ethylene, natural gas, benzene. Products: acetone (168,000 mt/y), ammonia (216,672 mt/y), ethylene (260,000 mt/y), methanol (420,000 mt/y), phenol (276,694 mt/y), polyvinyl chloride (317,662 mt/y), vinyl chloride (544,316 mt/y).

### GEORGIA-PACIFIC CORP.

**Albany, Oregon.** Feed: methanol. Product: formaldehyde (77,111 mt/y).

**Columbus, Ohio.** Feed: methanol. Product: formaldehyde (101,152 mt/y).

**Conway, N.C.** Feed: methanol. Product: formaldehyde (57,607 mt/y).

**Crossett, Ark.** Feed: methanol. Product: formaldehyde (74,843 mt/y).

**Lufkin, Tex.** Feed: methanol. Product: formaldehyde (53,978 mt/y).

**Hampton, S.C.** Feed: methanol. Product: formaldehyde (27,216 mt/y).

**Russellville, S.C.** Feed: methanol. Product: formaldehyde (111,131 mt/y).

**Taylorsville, Miss.** Feed: methanol. Product: formaldehyde (72,576 mt/y).

**Vienna, Ga.** Feed: methanol. Product: formaldehyde (47,628 mt/y).

### BFGOODRICH CO. GEON VINYL DIVISION

**Avon Lake, Ohio, Calvert City and Louisville, Ky., Deer Park and LaPorte, Tex., Henry, Ill., Long Beach, Calif., Pedricktown, N.J., Plaquemine, La., Terre Haute, Ind.** Products: vinyl chloride monomer and vinyl resins.

### GOODYEAR TIRE & RUBBER CO.

**Beaumont, Tex.** Feed: C-5 streams, butadiene. Products: isoprene (81,600 mt/y), polyisoprene (60,000 mt/y), polybutadiene (182,000 mt/y).

**Calhoun, Ga.** Feed: butadiene, styrene. Product: SBR (41,000 mt/y).

**Houston, Tex.** Feed: acrylonitrile, butadiene-styrene. Products: acrylonitrile-butadiene rubber (14,000 mt/y), styrene-butadiene rubber (310,000 mt/y).

**Niagara Falls, N.Y.** Feed: vinyl chloride monomer. Product: polyvinyl chloride (54,000 mt/y).

**Point Pleasant, W. Va.** Feed: tpa, ethylene glycol. Product: polyester (154,000 mt/y).

### W.R. GRACE & CO.

**Memphis, Tenn.** Feed: natural gas. Products: ammonia (308,400 mt/y), urea (349,300 mt/y).

### GREEN VALLEY CHEMICAL CORP.

**Creston, Iowa.** Feed: natural gas. Product: ammonia (100 mt/d).

### HAWKEYE CHEMICAL CO.

**Clinton, Iowa.** Feed: natural gas and hydrogen. Products: ammonia (200,000 mt/y), urea (60,000 mt/y).

### HERCULES INC.

**Louisiana, Mo.** Feed: natural gas. Product: formaldehyde (80,000 mt/y).

### HILL PETROLEUM CO.

**Houston, Tex.** Feed: crude and intermediate feedstocks. Products: benzene (14,000 mt/y), ethylbenzene (29,000 mt/y), MTBE (61,000 mt/y), normal paraffins (26,000 mt/y), propylene (163,000 mt/y), toluene (48,000 mt/y), xylene mix (53,000 mt/y).

**Texas City, Tex.** Feed: crude. Product: propylene (66,000 mt/y).

### HIMONT USA INC.

**Bayport, Tex.** Feed: propylene. Product: polypropylene (380,000 mt/y).

**Lake Charles, La.** Feed: propylene. Product: polypropylene (380,000 mt/y).

### HOECHST CELANESE CORP.

**Bay City, Tex.** Feed: ethylene, propylene. Product: butanol (125,000 mt/y), vinyl acetate (260,000 mt/y).

**Bayport, Tex.** Feed: benzene, ethylene. Product: high molecuar weigth hd polyethylene (160,000 mt/y).

**Bishop, Tex.** Feed: natural gas. Products: formaldehyde (818,000 mt/y), methanol (500,000 mt/y).

**Clear Lake, Tex.** Feed: natural gas, ethylene. Products: acetic acid (530,000 mt/y), acrylic acid-esters (170,000 mt/y), ethylene glycol (230,000), ethylene oxide (250,000 mt/y), vinyl acetate (230,000 mt/y).

**Newark, N.J.** Feed: methanol. Product: formaldehyde (55,000 mt/y).

**Pampa, Tex.** Feed: butane. Products: acetic acid (250,000 mt/y), acetic anhydride (95,000 mt/y).

**Rock Hill, S.C.** Feed: methanol. Product: formaldehyde (55,000 mt/y).

**Spartanburg, S.C.** Feed: DMT, TPA, glycol. Products: polyester (200,000 mt/y).

### J.M. HUBER CORP.

**Baytown, Tex.** Feed: refinery bottoms. Product: carbon black (318 mt/d).

**Borger, Tex.** Feed: refinery bottoms. Product: carbon black (235 mt/d).

**Orange, Tex.** Feed: refinery bottoms. Product: carbon black (167 mt/d).

### HÜLS AMERICA INC.

**Chestertown, Md.** Feed: alcohols, phthalic anhydride. Product: plasticizers (36,000 mt/y).

### IMC FERTILIZER INC.

**Sterlington, La.** Feed: natural gas. Product: ammonia (900,000 mt/y).

**KOPPERS CI**

**Bridgeville, Pa.** Product: polyester.

**Chicago, Ill.** Feed: naphthalene, orthoxylene. Products: phthalic anhydride (57,000 mt/y), polyester.

**Follansbee, W. Va.** Feed: coal tar. Product: naphthalene (70,000 mt/y).

**Oxnard, Calif.** Product: polyester.

**Richmond, Calif.** Product: polyester.

**LaROCHE INDUSTRIES INC.**

**Cherokee, Alabama.** Feed: natural gas. Product: ammonia (175,000 mt/y).

**LYONDELL PETROCHEMICAL CO.**

**Channelview, Tex.** Feed: ethane, gas oils, naphthas, mixed $C_4$'s, natural gas, propane. Products: benzene (274,000 mt/y), butadiene (216,000 mt/y), butylenes (209,000 mt/y), ethylene (1,270,000 mt/y), isoprene (41,000 mt/y), methanol (662,000 mt/y), propylene (839,000 mt/y), toluene (100,000 mt/y).

**Houston, Tex.** Feed: refinery feeds. Products: benzene (184,000 mt/y), orthoxylene (110,000 mt/y), paraxylene (150,000), toluene (100,000 mt/y).

**MARATHON PETROLEUM CO.**

**Detroit, Mich.** Feed: refinery. Product: propylene (63,500 mt/y).

**Garyville, La.** Feed: refinery. Product: propylene (60,500 mt/y).

**Texas City, Tex.** Feed: refinery. Products: aromatics mix (7,600 mt/y), benzene (24,500 mt/y), propylene (62,500 mt/y), toluene (60,500 mt/y), xylene mix (37,700 mt/y).

**MELAMINE CHEMICALS INC.**

**Donaldsonville, La.** Feed: urea. Product: melamine (45,000 mt/y).

**MISSISSIPPI CHEMICAL CORP.**

**Yazoo City, Miss.** Feed: natural gas. Product: ammonia (1,270 mt/d), urea (490 mt/d).

**MOBIL CHEMICAL CO.**
(division of Mobil Oil Corp.)

**Beaumont, Tex.** Feed: natural gas liquids, reformate. Products: benzene (351,000 mt/y), butadiene (27,000 mt/y), butylenes (14,000 mt/y), ethylene (565,000 mt/y), polyethylene (465,000 mt/y), propylene (145,000 mt/y), toluene (148,000 mt/y).

**Chalmette, La.** Feed: reformate. Products: benzene (67,000 mt/y), orthoxylene (68,000 mt/y), paraxylene (77,100 mt/y), toluene (131,700 mt/y), xylene mix (13,900 mt/y), solvents (53,200 mt/y).

**Houston, Tex.** Feed: natural gas liquids. Products: ethylene (245,000 mt/y), propylene (86,200 mt/y).

**Holyoke, Mass.** Feed: styrene. Products: polystyrene (36,000 mt/y).

**Joliet, Ill.** Feed: styrene. Product: polystyrene (166,000 mt/y).

**Santa Ana, Calif.** Feed: styrene. Product: polystyrene (27,000 mt/y).

**MONSANTO**

**Addyston, Ohio; Muscatine, Iowa.** Product: ABS (259,000 mt/y).

**Alvin, Tex.** Feed: propylene. Product: acrylonitrile (210,000 mt/y).

**Luling, La.** Feed: natural gas. Product: ammonia (210,000 mt/y).

**Pensacola, Fla.** Feed: butane. Product: maleic anhydride (109,000 mt/y).

**NESTE RESINS CORP.**

**Andalusia, Ala.** Feed: methanol. Product: formaldehyde (48,000 mt/y).

**Moncure, N.C.** Feed: methanol. Product: formaldehyde (50,000 mt/y).

**Springfield, Ore.** Feed: methanol. Product: formaldehyde (123,000 mt/y).

**Winnfield, La.** Feed: methanol. Product: formaldehyde (50,000 mt/y).

**NIPRO INC.**
(NV DSM subsidiary)

**Augusta, Ga.** Feed: cyclohexane. Product: caprolactam (165,000 mt/y).

**N-REN CORP.**

**Carlsbad, N.M.** Feed: natural gas. Product: ammonia (70,000 mt/y).

**East Dubuque, Ill.** Feed: natural gas. Product: ammonia (250,000 mt/y).

**Pine Bend, Minn.** Feed: natural gas. Product: ammonia (27,000 mt/y).

**Pryor, Okla.** Feed: natural gas. Product: ammonia (75,000 mt/y).

**OCCIDENTAL CHEMICAL CORP.**

**Addis, La.** Feed: vinyl chloride. Product: polyvinyl chloride (181,000 mt/y).

**Burlington North, N.J.** Feed: vinyl chloride. Product: polyvinyl chloride (54,000 mt/y).

**Burlington South, N.J.** Feed: vinyl chloride. Product: polyvinyl chloride (54,000 mt/y).

**Convent, La.** Product: ethylene dichloride (363,000 mt/y).

**Deer Park, Tex.** Feed: ethylene, chlorine. Products: ethylene dichloride (74,000 mt/y), vinyl chloride (500,000 mt/y).

**Pasadena, Tex.** Feed: vinyl chloride monomer. Product: polyvinyl chloride (431,000 mt/y).

**Pottstown, Pa.** Feed: vinyl chloride. Product: polyvinyl chloride (100,000 mt/y).

**Tacoma, Wash.** Feed: hydrogen, nitrogen. Product: ammonia (30,000 mt/y).

**OKLAHOMA NITROGEN CO.**
(62.5% W.R. Grace, 37.5% Terra International)

**Woodward, Okla.** Feed: natural gas. Products: ammonia (450,000 mt/y), urea (100,000 mt/y).

**OLIN CORP.**

**Lake Charles, La.** Feed: natural gas. Products: ammonia (480,000 mt/y), urea (214,000 mt/y).

**PHILLIPS 66 CO.**

**Borger, Tex.** Feed: crude oil, NGL. Product: cyclohexane (130,000 mt/y).

**Pasadena, Tex.** Feed: butadiene, ethylene, propylene, styrene. Products: polyisoprene (218,000 mt/y), styrene-butadiene resin (82,000 mt/y).

**Sweeny, Tex.** Feed: benzene, crude oil, natural gas liquids. Products: benzene (50,000 mt/y), cyclohexane (288,000 mt/y), ethylene (1,089,000 mt/y), propylene (254,000 mt/y), toluene (120,000 mt/y), xylene mix (108,000 mt/y).

**POLYSAR INC.**

**Copley, Ohio.** Feed: styrene. Product: polystyrene (70,000 mt/y).

**Decatur, Ala.** Feed: styrene. Product: polystyrene.

**Forest City, N.C.** Product: polystyrene (18,000 mt/y).

**Leominster, Mass.** Feed: styrene. Product: polystyrene (82,000 mt/y).

**Orange, Tex.** Feed: butadiene, ethylene, propylene. Products: butadiene rubber (88,000 mt/y), edpm (35,000 mt/y).

**Springfield, Mass.** Feed: styrene. Product: polystyrene.

**PPG INDUSTRIES INC.**

**Lake Charles, La.** Feed: ethylene. Products: ethylchloride (68,000 mt/y), ethylene dichloride (665,000 mt/y), vinyl chloride (420,000 mt/y).

**QUANTUM CHEMICAL CORP.- USI Division**

**Clinton, Iowa.** Feed: ethane-propane mix. Products: butadiene (17,000 mt/y), ethylene (365,000 mt/y), ld polyethylene (195,500 mt/y), hd polyethylene (159,000 mt/y), propylene (14,000 mt/y).

**Chocolate Bayou, Tex.** Product: hd polyethylene (181,800 mt/y).

**Houston, Texas.** Feed: carbon monoxide, ethylene, methanol. Products: acetic acid (363,600 mt/y), ld polyethylene (207,000 mt/y), hd polyethylene (250,000 mt/y), vinyl acetate (272,200 mt/y).

**Morris, Ill.** Feed: butane, ethane, propane. Products: butadiene (110,000 mt/y), ethylene (455,000 mt/y), ethylene glycol (96,500 mt/y), ethylene oxide (41,000 mt/y), ld polyethylene (245,500 mt/y), lld polyethylene (113,600 mt/y), polypropylene (120,400 mt/y), propylene (110,000 mt/y).

**Port Arthur, Texas.** Feed: ethylene. Products: lld polyethylene (136,400 mt/y), ld polyethylene (86,000 mt/y), hd polyethylene (154,500 mt/y).

**Tuscola, Illinois.** Feed: ethylene. Products: ethanol (198,000 mt/y), ethylene (182,000 mt/y), ld polyethylene (77,000 mt/y).

**REICHHOLD CHEMICAL INC.**

**Hampton, S.C.** Feed: methanol. Product: formaldehyde.

**Houston, Tex.** Feed: methanol. Product: formaldehyde.

**Kansas City, Kans.** Product: formaldehyde.

**Tacoma, Wash.** Product: formaldehyde.

**REXENE PRODUCTS CO.**

**Bayport, Tex.** Feed: ethylene, propylene. Products: ld polyethylene (110,000 mt/y), polypropylene (140,000 mt/y).

**Odessa, Tex.** Feed: benzene, ethane, propane. Products: ethylene (230,000 mt/y), polyethylene (186,000 mt/y), polypropylene (100,000 mt/y), propylene (100,000 mt/y), styrene (140,000 mt/y).

**ROHM AND HAAS CO.**

**Bayport, Tex; Bristol and Croydon, Pa; Calumet City, Ill; Fayetteville, N.C.; Hayward, Calif; Louisville, Ky.** Products: acrylics, acrylic esters, plasticizers, polyester, polyethylene, specialty acrylic monomers and polymers.

**Deer Park, Texas.** Feed: natural gas, propylene. Products: acrylic acid and esters (280,000 mt/y).

**RUBICON INC.**

**Geismar, La.** Feed: benzene. Product: aniline (136,000 mt/y).

**SHELL CHEMICAL CO.**

**Deer Park, Tex.** Feed: natural gas liquids, petroleum fractions. Products: acetone (195,000 mt/y), benzene (500,000 mt/y), bisphenol A (160,000 mt/y), butadiene (226,000 mt/y), cumeme (360,000 mt/y), ethylene (1,315,000 mt/y), isoprene concentrate (49,000 mt/y), isopropanol (225,000 mt/y), methyl isobutyl ketone (27,000 mt/y), normal butyl alcohol (65,000 mt/y), normal paraffins (99,000 mt/y), phenol (247,000 mt/y), propylene (770,000 mt/y), resins (90,000 mt/y), toluene (170,000 mt/y), vinyl chloride (380,000 mt/y), xylene mix (180,000 mt/y).

**Geismar, La.** Feed: ethylene. Products: linear $C_4$ + olefins (317,000 mt/y), ethylene glycol (227,000 mt/y), ethylene oxide (365,000 mt/y), glycol ethers (30,000 mt/y).

**Marietta, Ohio.** Product: thermoplastic rubber (170,000 mt/y).

**Norco, La.** Feed: natural gas liquids, petroleum fractions. Products: butadiene (225,000 mt/y), ethylene (1,016,000 mt/y), MEK (105,000 mt/y), polypropylene (136,000 mt/y), propylene (635,000 mt/y), vinyl chloride (320,000 mt/y).

**Odessa, Tex.** Product: benzene (16,000 mt/y).

**Taft, La.** Product: polybutylene (30,000 mt/y).

**Wood River, Ill.** Product: benzene (150,000 mt/y).

**SHELL CHEMICAL CO. and UNION CARBIDE CORP.**
(Joint ownership)

**Seadrift, Tex.** Product: polypropylene (90,000 mt/y).

**SHINTECH INC.**

**Freeport, Tex.** Feed: vinyl chloride monomer. Product: polyvinyl chloride (680,000 mt/y).

**SID RICHARDSON CARBON CO.**

**Addis, La.** Feed: heavy oil and natural gas. Product: carbon black (61,000 mt/y).

**Big Spring, Tex.** Feed: heavy oil. Product: carbon black (53,000 mt/y).

**Borger, Tex.** Feed: heavy oil. Product: carbon black (97,000 mt/y).

**SIMPLOT & CO., J.R.**

**Pocatello, Idaho.** Feed: natural gas. Product: ammonia (275 mt/d)

**SOLTEX POLYMER CORP.**
(subsidiary of Solvay & Cie.)

**Deer Park, Tex.** Feed: ethylene, propylene. Product: lld and hd polyethylene (545,000 mt/y), polypropylene (250,000 mt/y).

**STEPAN CO.**

**Joliet, Ill.** Feed: orthoxylene. Product: phthalic anhydride (87,982 mt/y).

**SUN REFINING & MARKETING CO.**

**Marcus Hook, Pa.** Feed: crude, purchased naphthas. Products: benzene (100,000 mt/y), ethylene (86,000 mt/y), ethylene oxide (44,000 mt/y), propylene (200,000 mt/y), toluene (75,000 mt/y), xylene mix (100,000 mt/y).

**Toledo, Ohio.** Feed: crude. Products: benzene (60,000 mt/y), toluene (200,000 mt/y), xylene mix (200,000 mt/y).

**Tulsa, Okla.** Feed: crude. Products: benzene (5,000 mt/y), cyclohexane (100,000 mt/y).

**SUNOLIN CHEMICAL CO.**

**Claymont, Del.** Feed: refinery dry gas, oxygen. Products: ethylene (108,863 mt/y), ethylene oxide (45,352 mt/y).

**TENNECO OIL CO.**

**Pasadena, Tex.** Feed: natural gas. Product: methanol (407,697 mt/y).

**TENNESSEE VALLEY AUTHORITY**

**Muscle Shoals, Ala.** Feed: natural gas. Products: ammonia (200 mt/d), urea (300 mt/d).

**TERRA INTERNATIONAL INC.**

**Sioux City (Port Neal), Iowa.** Feed: natural gas. Products: ammonia (720 mt/d), urea (730 mt/d).

**Woodward, Okla.** Feed: natural gas. Product: ammonia (1,300 mt/d).

**TEXACO CHEMICAL CO.**

**Delaware City, Del.** Feed: petroleum fractions. Products: benzene (50,000 mt/y), naphthalene (27,000 mt/y), toluene (99,000 mt/y).

**El Dorado, Kans.** Feed: petroleum fractions. Products: acetone (25,000 mt/y), benzene (56,000 mt/y), cumene (64,000 mt/y), phenol (43,000 mt/y), toluene (60,000 mt/y).

**Port Arthur, Tex.** Feed: ethane, butane, propane, naphtha. Products: aromatics (290,000 mt/y), benzene (200,000 mt/y), butadiene (51,000 mt/y), cyclohexane (220,000 mt/y), ethylene (550,000 mt/y), propylene (317,500 mt/y).

**Port Neches, Tex.** Feed: NGL. Products: butadiene (272,000 mt/y), ethylene (115,000 mt/y), ethylene glycol (333,000 mt/y), ethylene oxide (409,000 mt/y), propylene (135,000 mt/y).

**TEXAS EASTMAN CO.**

**Harrison County, Tex.** Feed: ethane, propane. Products: acetaldehyde (242,000 mt/y), aromatics mix (67,000 mt/y), butanol (100,000 mt/y), butylenes-butadiene mix (50,000 mt/y), butyraldehyde (370,000 mt/y), ethanol (89,000 mt/y), ethylene (650,000 mt/y), ethylene glycol (110,000 mt/y), ethylene oxide (100,000 mt/y), oxoalcohols (250,000 mt/y), ld polyethylene (300,000 mt/y), polypropylene (70,000 mt/y), propylene (300,000 mt/y), solvents (200,000 mt/y).

**TEXAS PETROCHEMICALS CORP.**
(subsidiary of Texas Olefins Co.)

**Houston, Tex.** Feed: mixed $C_4$ olefins, diolefins, isobutane, methanol. Products: butadiene (350,000 mt/y), butene 1 (90,000 mt/y), diisobutylene (30,000 mt/y), isobutylene (25,000 mt/y), MTBE (470,000 mt/y).

**TRIAD CHEMICAL CO.**
(joint venture Mississippi Chemical and First Mississippi Corp.)

**Donaldsonville, La.** Feed: natural gas. Products: ammonia (380,000 mt/y), urea (475,000 mt/y).

**UNION CARBIDE CORP.**

**Bound Brook, N.J.** Feed: cumene, petroleum derived feedstocks, derivatives. Products: acetone (50,000 mt/y), formaldehyde (45,000 mt/y), phenol (80,000 mt/y), polystyrene.

**Seadrift, Tex.** Feed: ethane, propane. Products: acetylene (9,000 mt/y), butadiene, ethylbenzene (170,000 mt/y), ethylene (562,300 mt/y), ethylene glycol, ethylene oxide, oxoalcohols, ld polyethylene (227,000 mt/y), lld-hd polyethylene (455,000 mt/y), polypropylene (90,000 mt/y), propylene, styrene (136,000 mt/y), solvents.

**Taft, La.** Feed: ethane, propane, butane, paraffinate, naphtha. Products: acetic acid, acetylene (5,000 mt/y), acrylic acid and acrylic esters (90,000 mt/y), benzene (230 mt/y), butadiene, ethylene (498,900 mt/y), ethylene dichloride (70,000 mt/y), ethylene glycol, ethylene oxide, lld-hd polyethylene (364,000 mt/y), propylene.

**Texas City, Tex. and Ponce, Puerto Rico.** Feed: butadiene, ethylene, propylene. Products: acetylene (63,000 mt/y), butanol (168,000 mt/y), butyraldehyde (195,000 mt/y), ethanol (339,000 mt/y), ethylene—Ponce (412,700 mt/y), ethylene—Texas City (702,300 mt/y), isopropanol (349,000 mt/y).

**UNOCAL CHEMICALS DIVISION**

**Beaumont, Tex.** Feed: reformate. Products: benzene (51,100 mt/y), cyclohexane (50,000 mt/y), toluene (95,800 mt/y), xylene mix (105,900 mt/y).

**Brea, Calif.** Feed: natural gas. Products: ammonia (227,000 mt/y), urea (109,000 mt/y).

**Bridgeview and Lemont, Ill.** Product: polymers (62,900 mt/y).

**Charlotte, N.C.** Product: polymers (133,000 mt/y).

**Kenai, Alaska.** Feed: natural gas. Products: ammonia (1,034,000 mt/y), urea (907,000 mt/y).

**La Mirada and Newark, Calif.** Product: polymers (73,200 mt/y).

**Lemont, Ill.** Feed: reformate, primary light oil. Products: benzene (92,000 mt/y), toluene (50,400 mt/y), xylene mix (35,300 mt/y).

**UNIROYAL CHEMICAL CO.**

**Geismar, La.** Feed: ethylene, propylene. Product: ethylene-propylene rubber (44,000 mt/y).

**VISTA CHEMICAL CO.**

**Aberdeen, Miss.** Feed: vinyl chloride monomer. Product: polyvinyl chloride (206,000 mt/y).

**Oklahoma City, Okla.** Feed: vinyl chloride. Product: polyvinyl chloride (156,000 mt/y).

**Baltimore, Md.** Feed: benzene, n-paraffins, chlorine. Products: alkylbenzene (131,000 mt/y).

**West Lake, La.** Feed: benzene, ethane, kerosine, chlorine. Products: alkylbenzene (91,000 mt/y), aromatics (12,000 mt/y), butadiene (15,000 mt/y), ethylene (317,000 mt/y), n-paraffins (150,000 mt/y), propylene (10,000 mt/y), vinyl chloride (374,000 mt/y).

**VULCAN CHEMICALS**

**Geismar, La.** Feed: ethylene. Product: ethylene dichloride (150,000 mt/y).

## URUGUAY

**ITALCOLOR SA**

**San José.** Feed: methanol. Product: formaldehyde (7,200 mt/y).

## VENEZUELA

**ESTIZULIA—Estireno del Zulia**
(37.5% Pequiven, 37.5% Grupo Zuliano CA, 25% Dow Chemical)

**Zuliz-El Tablazo Complex.** Feed: styrene. Product: polystyrene (40,000 mt/y).

**INTEQUIM—Quimica Integrada**

**Valencia.** Products: acrylics (1,259 mt/y), alkyds (9,723 mt/y), formaldehyde (7,0680 mt/y), polyamide (160 mt/y), polyester (1,820 mt/y).

**NEGROVEN**

**Valencia.** Feed: aromatic oil. Product: carbon black (65,000 mt/y).

**NITROVEN—Venezolana del Nitrogeno**
(Pequiven, Instituto Fomento Industrial, International Development & Investment Co. Ltd.)

**Zulia-El Tablazo Complex.** Feed: natural gas. Products: ammonia (594,000 mt/y-two units), urea (792,000 mt/y-two units).

**OXIDOR—Oxidaciones Orgánicas**
(59.44% Corimon, 29.13% Corpoquim, 11.3% Pequiven)

**Valencia, Edo. Carabobo.** Feed: orthoxylene. Product: phthalic anhydride (18,000 mt/y).

**PEQUIVEN—Petroquimica de Venezuela.**

**Anzoategui.** Feed: natural gas. Products: ethylene (400,000 mt/y).

**Morón, Edo Carabobo.** Feed: natural gas. Products: alkylbenzene (70,000 mt/y), ammonia (198,000 mt/y), urea (248,000 mt/y), phthalic anhydride (18,000 mt/y).

**Zulia-El Tablazo Complex.** Feed: ethane, natural gas, propane. Products: ammonia (594,000 mt/y), ethylene (150,000 mt/y), polyethylene (132,500), polystyrene (70,000 mt/y), propylene (35,000 mt/y).

**PETROPLAS—Plásticos Petroquímica**
(100% Pequiven)

**Zulia-El Tablazo.** Feed: chlorine, ethylene. Products: ethylene dichloride (72,000 mt/y), polyvinyl chloride (40,000 mt/y), vinyl chloride (44,000 mt/y).

**PLASTILAGO—Plásticos del Lago**
(49% Pequiven, 31.45% Grupo Zuliano CA, 15% CdF Chimie, 4.55% Mitsui Petrochemical)

**Zulia-El Tablazo.** Feed: ethylene. Product: hd polyethylene (60,000 mt/y).

**POLILAGO—Polimeros del Lago.**
(40% Pequiven, 30% Grupo Zuliano CA, 30% Cdf Chimie)

**Zulia-El Tablazo Complex.** Feed: ethylene. Product: ld polyethylene (60,000 mt/y).

**QUÍMICA VENOCO**
(Shell 15%, Industrias Venoco 55%, Pequiven 15%, Phillips Investment 15%)

**Guacara, Edo. Carabobo.** Feed: benzene, propylene. Product: alkylbenzene (56,000 mt/y).

## VIRGIN ISLANDS

**ST CROIX PETROCHEMICAL CORP.**
(joint venture Amerada Hess Corp. and Hercofina)

**St. Croix.** Feed: mixed xylenes. Product: paraxylene (275,000 mt/y).

## YUGOSLAVIA

**DINA P.O. (INA GROUP)**

**Omisalj.** Feed: ethylene, EDC. Products: ethlene dichloride (116,000 mt/y), vinyl cholride (150,000 mt/y), ld polyethylene (69,000 mt/y).

**DOW CHEMICAL CO.**

**Zagreb.** Product: polystyrene.

**JUGOVINIL**

**Kastel Sucurac.** Product: polyvinyl chloride (85,0000 mt/y).

# U.S. oil demand to climb in 1990

**Robert J. Beck**
Economics Editor

Continued economic growth coupled with stable or slowly declining petroleum product prices will boost U.S. oil demand in 1990.

Last year product demand grew minimally due to substantial increases in product prices and competition from other fuels in the industrial and utility markets.

While demand grows, domestic supply will sag again.

A record low year for exploration and drilling activity in 1989 extended a U.S. crude oil production slide that began in 1986. And the Mar. 24 Exxon Valdez oil spill off Alaska steepened the decline by reducing average North Slope output.

This year's production decline—275,000 b/d—won't be as great.

Slowing the decline rate will be a production increase off California and a rise in drilling activity. But Alaskan North Slope production is beginning to decline, which will accelerate the overall decline rate in later years unless major new fields are brought on stream.

Imports will move up to fill the gap between increased consumption and falling domestic production, reaching their second highest level in history. Import dependency will climb to a record high 48% of domestic demand.

Oil price stability and growing demand for natural gas will encourage drilling this year, although the active rig count will remain low.

The key to 1990 again will be the ability of the Organization of Petroleum Exporting Countries to keep group output attuned to worldwide demand.

Overproduction seems likely during the first half of the year, which will weaken prices.

To stabilize the market, OPEC members must respond to first signs of price weakness by reducing production to quotas set last November.

If overproduction continues, prices will slump as they did in 1986 and 1988.

Here are highlights of Oil & Gas Journal's forecasts for 1990:

- Total U.S. energy demand will increase 1.2% to 82.08 quadrillion BTU (quads). Consumption of all major types of energy will increase.

The greatest percentage increase, 9.1%, will be posted by hydroelectric, geothermal, and other sources as hydroelectric output continues to recover from the 1988 drought. Nuclear energy growth will slow to 1.2% from 2.5% last year and 15.7% in 1988.

- U.S. petroleum product demand will move up 1.1% to 17.5 million b/d. This follows an increase of 0.2% in 1989, when demand averaged 17.31 million b/d. This year's demand will be highest since 1979.
- U.S. crude and condensate production will slide 3.6% to 7.4 million b/d, lowest since 1962. Production last year fell 5.7%.
- Total industry imports will move up another 5.4% to 8.43 million b/d.

Peak import year was 1977, with an average of 8.786 million b/d.

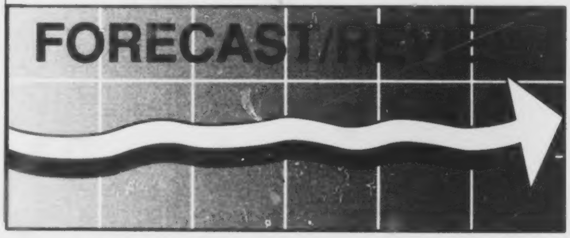
- Input to refineries will rise 0.5% to 13.65 million b/d. Average refining capacity is expected to slip 0.4% to 15.6 million b/d. The refinery utilization rate will move up to 87.5%.
- Natural gas consumption will increase 0.9% to 18.51 tcf for the year. This follows a 1.8% increase last year. Domestic production will be up 0.7% at 17.91 tcf. Imports will increase 9.9% to 1.5 tcf.

***NATURAL GAS DRILLING,** like this action under way for Occidental Oil & Gas Corp. in the Kansas section of Hugoton field, will pace rig activity and completions in 1990.*

### GNP, energy growth

Economic growth—an important factor in energy demand—will slow for the second consecutive year in 1990.

Last year, the gross national product (GNP) in 1982 dollars increased by an estimated 2.9[illegible], compared with 4.42% the year before. It was the seventh consecutive year of economic growth. Increases in industrial production, consumer spending, and capital investment fueled the 1989 growth.



## U.S. energy demand

|  | 1988 | 1989 | % change 1989/88 | 1990 Trillion BTU | % change 1990/89 | % share of market |
|---|---|---|---|---|---|---|
|  | Trillion BTU |  |  |  |  |  |
| Oil | 34,209 | 34,290 | + 0.2 | 34,670 | + 1.1 | 42.3 |
| Natural gas | 18,551 | 18,890 | + 1.8 | 18,990 | + 0.5 | 23.1 |
| Coal | 18,711 | 18,880 | + 1.0 | 19,050 | + 0.9 | 23.2 |
| Nuclear | 5,676 | 5,820 | + 2.5 | 5,890 | + 1.2 | 7.2 |
| Hydro & other | 2,920 | 3,190 | + 9.2 | 3,480 | + 9.1 | 4.2 |
| Total | 80,067 | 81,070 | + 1.3 | 82,080 | + 1.2 | 100.0 |

Source: 1988, EIA; 1989 and 1990 OGJ estimate

## U.S. natural gas supply and demand

|  | 1987 | 1988 | 1989 | % change, 1989/88 | 1990, bcf | % change 1990/89 |
|---|---|---|---|---|---|---|
|  | bcf |  |  |  |  |  |
| Production |  |  |  |  |  |  |
| Texas | 6,126 | 6,286 | 6,270 | − 0.3 | 6,310 | + 0.6 |
| Louisiana | 5,123 | 5,160 | 5,150 | − 0.6 | 5,180 | + 0.6 |
| Other states | 6,100 | 6,342 | 6,360 | + 0.3 | 6,420 | + 0.9 |
| Total production | 17,348 | 17,808 | 17,780 | − 0.2 | 17,910 | + 0.7 |
| Imports |  |  |  |  |  |  |
| Canada | 993 | 1,277 | 1,329 | + 4.1 | 1,460 | + 9.9 |
| Mexico | 0 | 0 | 0 | — | 0 | — |
| LNG* | 0 | 17 | 36 | + 111.8 | 40 | + 11.1 |
| Total imports | 993 | 1,294 | 1,365 | + 5.5 | 1,500 | + 9.9 |
| Supplemental gas | 101 | 101 | 146 | + 43.6 | 180 | + 24.1 |
| Losses, etc.† | − 1,171 | − 1,158 | − 910 | − 21.4 | − 1,000 | + 9.9 |
| Total new supply | 17,271 | 18,045 | 18,380 | + 1.9 | 18,590 | + 1.1 |
| Supply from storage | −6 | 57 | 40 | — | — | — |
| Total supply | 17,265 | 18,102 | 18,420 | + 1.8 | 18,590 | + 0.9 |
| Exports | 51 | 74 | 75 | + 1.4 | 80 | + 6.7 |
| Total consumption | 17,211 | 18,028 | 18,345 | + 1.8 | 18,510 | + 0.9 |

*LNG imports from Algeria. †Extraction losses and unaccounted for gas.
Source: 1987 and 1988, EIA; 1989 and 1990 OGJ estimate

The same sectors will support this year's real GNP growth, projected at 2%. Rates of increase will drop to about 1.8% for industrial activity, 2.3% for consumer spending, and 2.5% for capital investment.

Energy efficiency, in terms of consumption per dollar of GNP, improved last year after 3 stagnant years. Before 1986, energy efficiency had improved every year since 1970.

In 1986, GNP was 31.5% higher than its level of 1976, but energy consumption was 0.2% lower. Energy price declines in 1986 changed the trend, reducing the incentive for conservation and investment in efficiency. From 1986 through 1989 GNP increased 11.4%, while energy consumption moved up 9.2%.

In 1989 the economy used 19,600 BTU of energy per dollar of GNP. Long term energy efficiency improvements appear to be entrenched so the ratio is expected to fall again this year to 19,400 BTU/$ of GNP. From a base year of 1970, energy efficiency will have improved through year-end 1990 by 30%.

This year's expected 1.2% increase in energy consumption, with economic growth offsetting the efficiency gains, compares with a 1.3% consumption increase last year to 81.07 quads.

### Sector by sector demand

Oil energy demand will rise 1.1% to 34.67 quads. Oil's energy market share will be 42.3%, the same as last year but down from 42.7% in 1988 and 42.8% in 1987.

The oil share fell to 41.8% in 1985, when high prices made other fuels competitive. The sharp drop in prices in 1986 revived demand for oil, market share of which rebounded to 43.4%.

Demand for energy from natural gas will increase only 0.5% in 1990 to 18.99 quads. That compares with a 1.8% increase last year to 18.89 quads. Gas market share will fall to 23.1% in 1990 from 23.3% in 1989. Market share rose the 2 previous years after falling to 22.5% in 1986.

In the key electric utility market, where gas competes with all major energy sources, increased hydroelectric and nuclear output this year will restrict market share growth by gas.

Coal energy consumption will climb 0.9% in 1990 to 19.05 quads. Demand last year was up 1% at 18.88 quads. Market share will slip to 23.2% from 23.3% last year. Coal moved ahead of natural gas in 1986 to become the second leading fuel source.

It will be another slow year for nuclear power. Unscheduled plant shutdowns and a slowdown in capacity additions slowed growth last year to 5.82 quads. This year nuclear energy consumption will total 5.89 quads, 7.2% of the energy market.

The strong growth expected in 1990 in consumption of energy from hydro and geothermal power follows a 9.2% increase in 1989 to 3.19 quads. Output this year will amount to 3.48 quads—4.2% of the market.

### The production outlook

The expected 275,000 b/d U.S. crude and condensate production dip this year follows a 465,000 b/d drop last year to 7.675 million b/d. That total was down 1.296 million b/d from the recent peak of 8.971 million b/d in 1985.

U.S. drilling, depressed for several years by uncertain oil prices, has been far too low to offset natural production declines. The Baker Hughes active rig count set a modern record low in 1989 with an average of only 869. This followed 2 years when the average was only 936.

Interruption of North Slope production last spring simply aggravated a well established production slide that will be irreversible in 1990.

Total liquids production fell 5.3% to 9.3 million b/d in 1989, lowest since 1965. Total liquids output will fall 2.8% in 1990 to 9.04 million b/d.

Production of natural gas liquids (NGL) and other hydrocarbons not included in the crude and condensate total fell 53,000 b/d to 1.625 million b/d last year and will rise to 1.64 million b/d in 1990.

In Alaska, environmental constraints, many of them implemented in response to the Exxon Valdez spill, are slowing North Slope exploration and development activity that might otherwise bring on new production to offset natural declines.

Alaskan production will average 1.865 million b/d in 1990, compared with 1.878 million b/d in 1989 and 2.017 million b/d in 1988. The

## OGJ forecast of U.S. supply and demand

| | 1,000 b/d | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Year 1990 | % change 90/89 | Year 1989 | % change 89/88 | –1st qtr. 1990– Volume | –1st qtr. 1990– % Change | –2nd qtr. 1990– Volume | –2nd qtr. 1990– % Change | –3rd qtr. 1990– Volume | –3rd qtr. 1990– % Change | –4th qtr. 1990– Volume | –4th qtr. 1990– % Change |
| **DOMESTIC DEMAND** | | | | | | | | | | | | |
| Motor gasoline | 7,375 | + 0.5 | 7,335 | — | 7,100 | + 0.2 | 7,510 | + 0.7 | 7,525 | + 1.5 | 7,365 | − 0.3 |
| Dist. 1-4 | 6,110 | + 0.5 | 6,080 | − 0.1 | 5,880 | + 0.2 | 6,220 | + 0.7 | 6,230 | + 1.9 | 6,110 | − 0.7 |
| Dist. 5 | 1,265 | + 0.8 | 1,255 | + 0.3 | 1,220 | + 0.7 | 1,290 | + 0.9 | 1,295 | − 0.7 | 1,255 | + 1.8 |
| Naphtha jet fuel | 215 | + 2.4 | 210 | − 1.4 | 210 | + 7.7 | 220 | + 3.8 | 215 | + 2.4 | 215 | − 3.6 |
| Dist. 1-4 | 150 | + 3.4 | 145 | − 3.3 | 145 | +11.5 | 155 | + 4.7 | 150 | + 4.9 | 150 | − 4.5 |
| Dist. 5 | 65 | — | 65 | + 3.2 | 65 | — | 65 | + 1.6 | 65 | − 3.0 | 65 | − 1.5 |
| Kerosine jet fuel | 1,310 | + 2.6 | 1,277 | + 3.3 | 1,320 | + 1.2 | 1,270 | + 7.3 | 1,310 | + 4.4 | 1,340 | − 1.8 |
| Dist. 1-4 | 950 | + 2.5 | 927 | + 2.9 | 980 | + 1.1 | 910 | + 7.3 | 945 | + 5.9 | 965 | − 3.0 |
| Dist. 5 | 360 | + 2.9 | 350 | + 4.5 | 340 | + 1.5 | 360 | + 7.1 | 365 | + 0.6 | 375 | + 1.4 |
| Distillate | 3,165 | + 0.9 | 3,138 | + 0.5 | 3,545 | + 4.9 | 2,920 | − 1.9 | 2,820 | − 0.1 | 3,375 | — |
| Dist. 1-4 | 2,730 | + 0.7 | 2,710 | + 0.4 | 3,145 | + 5.0 | 2,470 | − 2.4 | 2,375 | − 0.2 | 2,930 | — |
| Dist. 5 | 435 | + 1.6 | 428 | + 1.2 | 400 | + 4.2 | 450 | + 0.9 | 445 | + 0.2 | 445 | + 0.5 |
| Residual | 1,385 | + 3.4 | 1,340 | − 2.8 | 1,555 | − 3.1 | 1,225 | − 1.0 | 1,275 | +13.9 | 1,485 | + 6.1 |
| Dist. 1-4 | 1,120 | + 3.7 | 1,080 | − 2.7 | 1,260 | − 4.3 | 990 | − 1.6 | 1,035 | +16.6 | 1,195 | + 7.0 |
| Dist. 5 | 265 | + 1.9 | 260 | − 3.0 | 295 | + 2.4 | 235 | + 1.7 | 240 | + 3.9 | 290 | + 2.5 |
| LPG and ethane | 1,675 | + 0.9 | 1,660 | + 0.2 | 1,935 | − 1.6 | 1,355 | − 4.9 | 1,560 | + 7.8 | 1,850 | + 2.7 |
| Dist. 1-4 | 1,610 | + 0.7 | 1,599 | + 0.7 | 1,860 | − 2.1 | 1,300 | − 5.3 | 1,505 | + 7.4 | 1,775 | + 2.8 |
| Dist. 5 | 65 | + 6.6 | 61 | −10.3 | 75 | +10.3 | 55 | + 5.8 | 55 | +19.6 | 75 | — |
| Other products | 2,375 | + 1.1 | 2,350 | + 0.3 | 2,095 | — | 2,345 | + 8.1 | 2,585 | + 2.9 | 2,475 | − 5.6 |
| Dist. 1-4 | 2,025 | + 0.7 | 2,010 | + 0.8 | 1,780 | − 0.2 | 1,995 | + 8.9 | 2,240 | + 2.5 | 2,085 | − 7.3 |
| Dist. 5 | 350 | + 2.9 | 340 | − 2.3 | 315 | + 0.6 | 350 | + 3.9 | 345 | + 5.5 | 390 | + 4.0 |
| **TOTAL DOMESTIC DEMAND** | **17,500** | **+ 1.1** | **17,310** | **+ 0.2** | **17,760** | **+ 0.7** | **16,845** | **+ 1.1** | **17,290** | **+ 3.0** | **18,105** | **− 0.4** |
| Dist. 1-4 | 14,695 | + 1.0 | 14,551 | + 0.2 | 15,050 | + 0.6 | 14,040 | + 0.9 | 14,480 | + 3.4 | 15,210 | − 0.7 |
| Dist. 5 | 2,805 | + 1.7 | 2,759 | + 0.1 | 2,710 | + 1.7 | 2,805 | + 2.3 | 2,810 | + 1.0 | 2,895 | + 1.8 |
| **EXPORTS** | **820** | **− 1.2** | **830** | **+ 1.8** | **830** | **− 0.2** | **840** | **+ 1.9** | **800** | **− 0.1** | **810** | **− 2.5** |
| Dist. 1-4 | 380 | + 0.3 | 379 | + 2.4 | 340 | + 0.3 | 380 | + 2.4 | 400 | − 1.7 | 400 | — |
| Dist. 5 | 440 | 2.4 | 451 | + 1.3 | 490 | + 0.6 | 460 | − 5.2 | 400 | + 1.5 | 410 | − 4.9 |
| **TOTAL DEMAND** | **18,320** | **+ 1.0** | **18,140** | **+ 0.2** | **18,590** | **+ 0.7** | **17,685** | **+ 1.0** | **18,090** | **+ 2.9** | **18,915** | **− 0.4** |
| Dist. 1-4 | 15,075 | + 1.0 | 14,930 | + 0.2 | 15,390 | + 0.6 | 14,420 | + 0.9 | 14,880 | + 3.3 | 15,610 | − 0.7 |
| Dist. 5 | 3,245 | + 1.1 | 3,210 | + 0.3 | 3,200 | + 1.3 | 3,265 | + 1.1 | 3,210 | + 1.1 | 3,305 | + 0.9 |
| **SUPPLY** | | | | | | | | | | | | |
| Crude & condensate | 7,400 | 3.6 | 7,675 | − 5.7 | 7,520 | − 3.4 | 7,430 | − 4.0 | 7,350 | − 2.5 | 7,300 | − 4.4 |
| Dist. 1-4 | 4,525 | 5.3 | 4,779 | − 1.5 | 4,625 | − 5.4 | 4,550 | − 5.5 | 4,485 | − 4.8 | 4,440 | − 5.5 |
| Dist. 5 | 2,875 | 0.7 | 2,896 | − 6.0 | 2,895 | — | 2,880 | − 1.5 | 2,865 | + 1.2 | 2,860 | − 2.6 |
| NGL and other hydrocar. | 1,640 | + 0.9 | 1,625 | − 3.2 | 1,655 | + 2.0 | 1,630 | − 1.0 | 1,625 | + 3.0 | 1,650 | + 4.0 |
| Dist. 1-4 | 1,540 | + 0.9 | 1,527 | − 3.2 | 1,553 | − 2.2 | 1,532 | − 1.1 | 1,529 | + 3.0 | 1,546 | + 4.0 |
| Dist. 5 | 100 | + 2.0 | 98 | − 3.0 | 102 | + 2.0 | 98 | — | 96 | + 3.2 | 104 | + 3.0 |
| **IMPORTS** | | | | | | | | | | | | |
| Crude | 6,100 | + 4.8 | 5,820 | +15.1 | 5,575 | + 7.5 | 6,080 | + 6.5 | 6,380 | + 3.0 | 6,365 | + 3.2 |
| Dist. 1-4 | 5,825 | + 4.9 | 5,554 | +14.4 | 5,395 | + 7.7 | 5,770 | + 6.7 | 6,070 | + 2.9 | 6,065 | + 3.2 |
| Dist. 5 | 275 | + 3.4 | 266 | +32.3 | 180 | + 4.0 | 310 | + 3.0 | 310 | + 4.7 | 300 | + 1.7 |
| Products and unfinished | 2,330 | + 6.9 | 2,180 | − 4.9 | 2,470 | − 2.1 | 2,150 | + 1.6 | 2,225 | +11.3 | 2,475 | +18.9 |
| Dist. 1-4 | 2,250 | + 6.8 | 2,106 | − 3.6 | 2,390 | − 2.3 | 2,045 | + 1.4 | 2,165 | +10.8 | 2,400 | +19.9 |
| Dist. 5 | 80 | + 8.1 | 74 | −31.5 | 80 | + 5.3 | 105 | + 4.0 | 60 | +33.3 | 75 | + 1.4 |
| **TOTAL IMPORTS** | **8,430** | **+ 5.4** | **8,000** | **+ 8.9** | **8,045** | **+ 4.4** | **8,230** | **+ 5.1** | **8,605** | **+ 5.0** | **8,840** | **+ 7.1** |
| Dist. 1-4 | 8,075 | + 5.4 | 7,660 | + 8.8 | 7,785 | + 4.4 | 7,815 | + 5.2 | 8,235 | + 4.9 | 8,465 | + 7.4 |
| Dist. 5 | 355 | + 4.4 | 340 | +10.0 | 260 | + 4.4 | 415 | + 3.2 | 370 | + 8.2 | 375 | + 1.6 |
| Processing gain, loss, etc. | 860 | + 1.2 | 850 | − 0.1 | 880 | + 2.1 | 840 | + 0.6 | 890 | + 0.7 | 830 | + 1.3 |
| Dist. 1-4 | 700 | + 0.7 | 695 | + 0.4 | 725 | + 2.1 | 680 | + 0.1 | 735 | − 0.4 | 660 | + 0.2 |
| Dist. 5 | 160 | + 3.2 | 155 | − 2.5 | 155 | + 2.0 | 160 | + 2.6 | 155 | + 6.2 | 170 | + 6.3 |
| **TOTAL NEW SUPPLY** | **18,330** | **+ 1.0** | **18,150** | **+ 0.7** | **18,100** | **+ 0.3** | **18,130** | **+ 0.5** | **18,470** | **+ 1.5** | **18,620** | **+ 1.8** |
| Dist. 1-4 | 14,840 | + 1.2 | 14,661 | + 2.1 | 14,688 | + 0.3 | 14,577 | + 0.8 | 14,984 | + 1.3 | 15,111 | + 2.6 |
| Dist. 5 | 3,490 | — | 3,489 | − 4.4 | 3,412 | + 0.5 | 3,553 | − 0.8 | 3,486 | + 2.2 | 3,509 | − 1.6 |
| **STOCK CHANGE** | **10** | **—** | **10** | **—** | **(490)** | **—** | **445** | **—** | **380** | **—** | **(295)** | **—** |
| Dist. 1-4 | (235) | — | (269) | — | (702) | — | 157 | — | 104 | — | (499) | — |
| Dist. 5 | 245 | — | 279 | — | 212 | — | 288 | — | 276 | — | 204 | — |
| **CRUDE RUNS TO STILLS** | **13,470** | **+ 0.5** | **13,405** | **+ 1.2** | **13,085** | **+ 0.5** | **13,480** | **+ 0.5** | **13,895** | **+ 0.5** | **13,420** | **+ 0.5** |
| **TOTAL INPUT TO STILLS** | **13,650** | **+ 0.5** | **13,580** | **+ 1.0** | **13,265** | **+ 0.3** | **13,660** | **+ 0.6** | **14,075** | **+ 0.9** | **13,600** | **+ 2.7** |
| **TOTAL REFINING CAPACITY** | **15,600** | **− 0.4** | **15,660** | **− 1.7** | **15,580** | **− 0.7** | **15,580** | **− 0.6** | **15,620** | **− 0.5** | **15,206** | **+ 0.2** |
| **REFINING UTILIZATION (%)** | **87.5** | **+ 0.9** | **86.7** | **+ 2.7** | **85.1** | **+ 1.3** | **87.7** | **+ 0.8** | **90.1** | **+ 1.2** | **87.1** | **+ 2.5** |
| **TOTAL INDUSTRY STOCKS†** | **1,045** | **+ 0.5** | **1,040** | **+ 0.3** | **996** | **− 0.7** | **1,036** | **—** | **1,072** | **− 1.9** | **1,045** | **+ 0.5** |
| Products | 705 | + 0.7 | 700 | − 1.0 | 661 | − 2.4 | 696 | − 1.3 | 722 | − 4.7 | 705 | + 0.7 |
| Crude | 340 | — | 340 | + 3.0 | 335 | + 2.8 | 340 | + 2.7 | 350 | + 4.5 | 340 | — |
| SPR stocks† | 600 | + 3.3 | 581 | + 3.8 | 586 | + 3.5 | 590 | + 3.1 | 595 | + 3.1 | 600 | + 3.3 |

*Preliminary estimate. †Million bbl at end of period.

139,000 b/d 1989 decline accounted for 26% of the drop in total U.S. production.

Lower 48 crude production this year will average 5.535 million b/d, down 262,000 b/d from 1989, when the average dropped 326,000 b/d from the previous year. The slower rate of decrease reflects the forecast drilling rise. But the average will be the lowest since 1950.

Lower 48 production in 1989 dropped 326,000 b/d to 5.797 million b/d. Production

| Year | Crude oil | | Products | | Natural gas | |
|---|---|---|---|---|---|---|
| | Average U.S. wellhead price | Average landed cost of imports | Unleaded gasoline pump price | No. 2 fuel oil wholesale price | Average U.S. wellhead price | Average consumer price |
| | ($/bbl) | | (¢/gal) | | ($/Mcf) | |
| 1976 | 8.19 | 13.34 | 61.4 | N.A. | 0.58 | 1.47 |
| 1977 | 8.57 | 14.31 | 65.6 | N.A. | 0.79 | 1.76 |
| 1978 | 9.00 | 14.38 | 67.0 | 36.9 | 0.91 | 1.98 |
| 1979 | 12.64 | 21.65 | 90.3 | 56.9 | 1.18 | 2.34 |
| 1980 | 21.59 | 33.95 | 124.5 | 80.3 | 1.59 | 2.91 |
| 1981 | 31.77 | 36.52 | 137.8 | 97.6 | 1.98 | 3.51 |
| 1982 | 28.52 | 33.18 | 129.6 | 91.4 | 2.46 | 4.32 |
| 1983 | 26.19 | 28.93 | 124.1 | 81.5 | 2.59 | 4.82 |
| 1984 | 25.88 | 28.46 | 121.2 | 82.1 | 2.66 | 4.85 |
| 1985 | 24.09 | 26.66 | 120.2 | 77.6 | 2.51 | 4.72 |
| 1986 | 12.51 | 13.49 | 92.7 | 48.6 | 1.94 | 4.13 |
| 1987 | 15.41 | 17.65 | 94.8 | 52.7 | 1.67 | 4.05 |
| 1988 | 12.58 | 14.08 | 94.6 | 47.3 | 1.69 | 4.09 |
| 1989* | 15.70 | 16.60 | 102.3 | 52.8 | 1.70 | 4.23 |

*Estimated.
Source: 1976-88, EIA; 1989 OGJ estimates

### U.S. energy efficiency

| Year | GNP (Billion 1982 dollars) | Energy consumption (Trillion BTU) | Energy consumption per GNP 1982 dollar (Thousand BTU) | Oil energy consumption (Trillion BTU) | Oil energy consumption per GNP 1982 dollar (Thousand BTU) |
|---|---|---|---|---|---|
| 1970 | 2,416 | 67,143 | 27.8 | 29,537 | 12.2 |
| 1971 | 2,485 | 68,348 | 27.5 | 30,570 | 12.3 |
| 1972 | 2,609 | 71,643 | 27.5 | 32,966 | 12.6 |
| 1973 | 2,744 | 74,282 | 27.1 | 34,840 | 12.7 |
| 1974 | 2,729 | 72,543 | 26.6 | 33,455 | 12.3 |
| 1975 | 2,695 | 70,545 | 26.2 | 32,731 | 12.1 |
| 1976 | 2,827 | 74,362 | 26.3 | 35,175 | 12.4 |
| 1977 | 2,959 | 76,289 | 25.8 | 37,122 | 12.5 |
| 1978 | 3,115 | 78,089 | 25.1 | 37,965 | 12.2 |
| 1979 | 3,192 | 78,897 | 24.7 | 37,123 | 11.6 |
| 1980 | 3,187 | 75,955 | 23.8 | 34,202 | 10.7 |
| 1981 | 3,249 | 73,991 | 22.8 | 31,931 | 9.8 |
| 1982 | 3,166 | 70,848 | 22.4 | 30,231 | 9.5 |
| 1983 | 3,279 | 70,524 | 21.5 | 30,054 | 9.2 |
| 1984 | 3,501 | 74,101 | 21.2 | 31,051 | 8.9 |
| 1985 | 3,613 | 73,945 | 20.4 | 30,922 | 8.5 |
| 1986 | 3,718 | 74,237 | 20.0 | 32,196 | 8.7 |
| 1987 | 3,854 | 76,845 | 19.9 | 32,865 | 8.5 |
| 1988 | 4,024 | 80,069 | 19.9 | 34,209 | 8.5 |
| 1989* | 4,143 | 81,070 | 19.6 | 34,290 | 8.3 |
| 1990† | 4,226 | 82,080 | 19.4 | 34,670 | 8.2 |

*Estimated. †Forecast.
Source: 1970-88, EIA; 1989 and 1990 OGJ estimates

in Texas fell 113,000 b/d to 1.949 million b/d. Louisiana's output was down 59,000 b/d at 1.158 million b/d, California dropped 46,000 b/d to 1.009 million b/d, and Oklahoma production fell 29,000 b/d to 323,000 b/d.

### Imports to grow

The 5.4% gain in total imports this year follows an 8.9% increase last year to an estimated 8 million b/d.

All of last year's increase was crude oil, imports of which jumped 15.1% to 5.82 million b/d, excluding imports for the Strategic Petroleum Reserve. Product imports fell 4.9% in 1989 to 2.18 million b/d.

This year, crude imports will increase 4.8% to 6.1 million b/d. Product imports will climb 6.9% to 2.33 million b/d.

The product import rebound will come as refiners make greater use of non-U.S. supplies to meet contingencies.

Import dependency is zooming. The projected record figure for imports as a percent of consumption this year, 48.2%, compares with 46.2% in 1989, 42.5% in 1988, and only 31.5% in 1985.

Crude oil imports for the SPR will remain at 50,000-55,000 b/d. At yearend 1989, SPR held 581 million bbl. The total will reach 600 million bbl at end 1990. In contrast, industry crude stocks have remained at 330-350 million bbl.

### Refining margins squeezed

For refiners last year, crude oil feedstock costs rose faster than product revenues, which narrowed margins. Partly offsetting that squeeze on refining profitability were demand growth, rising throughput, and increased utilization rates.

The average U.S. wellhead price of crude oil moved up 24.8% to an estimated $15.70/bbl in 1989. And the average landed cost of imported crude oil increased 12.2% to $16.60/bbl for the year.

Product prices did not move up as sharply. The average pump price of unleaded gasoline increased 8.1% to $1.023/gal for 1989. The average wholesale price of No. 2 fuel oil moved up 11.6% to 52.8¢/gal.

Average total crude runs increased 1.2% to 13.405 million b/d in 1989. Refining capacity was down 1.7% to 15.66 million b/d for the year. This combined to boost the refinery average utilization rate to 86.7% from 85.1% the year before. The higher utilization rate reduced operating cost per unit of output.

Through the first 9 months of 1989 average margins were positive but down about 15% from the year before.

Refining margins in 1990 will depend upon product demand and OPEC's ability to stabilize prices. Crude runs will be up 0.5% to 13.470 million b/d. If, as expected, OPEC production exceeds quotas in the first half, crude prices will sag, which will strengthen refining margins. Demand growing as projected will keep product prices from slumping as much as crude prices.

To help contain costs, refiners will continue to hold stocks at close to minimum levels. Total industry stocks will move up only 0.5% to 1.045 billion bbl by yearend 1990.

Crude oil stocks will remain at 340 million bbl. Product stocks, due to increased demand, will move up 5 million bbl to 705 million bbl at yearend. Stocks for some products are presently close to minimum operating levels.

### Petroleum demand to rise

With petroleum product prices unable to match inflation, the incentive to conserve oil will remain low—a key factor in OGJ's outlook for petroleum demand increase this year.

Demand will climb for all major products. The largest increase is expected for heavy fuel oil, prices of which will be weak.

Total demand, including exports, will be up 1% in 1990 at 18.32 million b/d. Exports will slip 1.2% to 820,000 b/d. Total demand was up 0.2% in 1989 at 18.14 million b/d, exports up 1.8% at 830,000 b/d.

# U.S. production of crude oil and lease condensate

| | *1989 | 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 | Cumulative 1859-1989 1,000 bbl |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | | | | | | |
| District 1: | | | | | | | | | | | |
| Fla., N.Y., Pa., W. Va. | 28 | 38 | 41 | [illegible] | 57 | 63 | 77 | 93 | 117 | 133 | 2,637,168 |
| **Total Dist. 1** | 28 | 38 | 41 | 47 | 57 | 63 | 77 | 93 | 117 | 133 | 2,637,168 |
| District 2: | | | | | | | | | | | |
| Illinois | 60 | 61 | 66 | 75 | 83 | 79 | 80 | 76 | 66 | 62 | [illegible] |
| Indiana | 10 | 10 | 10 | 13 | 14 | 15 | 15 | 15 | 13 | 14 | 515,873 |
| Kansas | 151 | 161 | 164 | 184 | 207 | 207 | 196 | 193 | 181 | 164 | 5,649,118 |
| Kentucky | 16 | 15 | 16 | 18 | 21 | 21 | 22 | 20 | 18 | 16 | 718,727 |
| Michigan | 61 | 64 | 71 | 70 | 75 | 83 | 87 | 86 | 89 | 92 | 1,067,536 |
| Nebraska | 18 | 16 | 17 | 19 | 19 | 18 | 17 | 19 | 18 | 17 | 442,274 |
| North Dakota | 101 | 107 | 113 | 125 | 139 | 144 | 139 | 129 | 124 | 110 | 1,005,394 |
| Ohio | 30 | 32 | 33 | 37 | 41 | 42 | 41 | 40 | 37 | 35 | 990,458 |
| Oklahoma | 325 | 352 | 368 | 409 | 446 | 460 | 435 | 435 | 422 | 410 | 13,224,931 |
| Others† | 6 | 7 | 7 | 6 | 7 | 8 | 7 | 7 | 7 | 4 | 39,032 |
| **Total Dist. 2** | 778 | 825 | 865 | 956 | 1,052 | 1,077 | 1,039 | 1,020 | 975 | 924 | 27,054,529 |
| District 3: | | | | | | | | | | | |
| Alabama | 55 | 57 | 56 | 58 | 59 | 54 | 51 | 55 | 57 | 61 | 425,426 |
| Arkansas | 33 | 37 | 39 | 43 | 52 | 51 | 52 | 52 | 50 | 50 | 1,641,499 |
| Louisiana | 1,158 | 1,217 | 1,320 | 1,404 | 1,393 | 1,408 | 1,314 | 1,256 | 1,231 | 1,263 | 21,117,407 |
| Mississippi | 76 | 75 | 77 | 82 | 84 | 90 | 86 | 91 | 94 | 98 | 1,986,494 |
| New Mexico | 189 | 195 | 198 | 207 | 215 | 216 | 206 | 195 | 196 | 206 | 4,214,711 |
| Texas | 1,949 | 2,062 | 2,137 | 2,300 | 2,435 | 2,472 | 2,473 | 2,535 | 2,589 | 2,672 | 52,639,755 |
| **Total Dist. 3** | 3,460 | 3,643 | 3,827 | 4,094 | 4,238 | 4,291 | 4,182 | 4,184 | 4,217 | 4,370 | 82,025,292 |
| District 4: | | | | | | | | | | | |
| Colorado | 83 | 88 | 79 | 80 | 83 | 79 | 80 | 84 | 83 | 81 | 1,562,630 |
| Montana | 57 | 64 | 69 | 74 | 82 | 81 | 80 | 85 | 84 | 81 | 1,294,763 |
| Utah | 78 | 90 | 98 | 107 | 112 | 95 | 81 | 61 | 71 | 68 | 993,037 |
| Wyoming | 295 | 311 | 315 | 332 | 352 | 339 | 324 | 324 | 358 | 345 | 5,762,244 |
| **Total Dist. 4** | 513 | 553 | 561 | 593 | 629 | 594 | 565 | 554 | 596 | 575 | 9,612,674 |
| District 5: | | | | | | | | | | | |
| Alaska | 1,878 | 2,017 | 1,962 | 1,867 | 1,826 | 1,722 | 1,713 | 1,696 | 1,609 | 1,617 | 8,409,850 |
| California | 1,009 | 1,055 | 1,084 | 1,115 | 1,161 | 1,126 | 1,109 | 1,099 | 1,055 | 975 | 22,389,358 |
| Nevada | 9 | 9 | 9 | 8 | 8 | 5 | 2 | 2 | 2 | 2 | 26,990 |
| Others§ | (s) | (s) | (s) | (s) | (s) | 1 | 1 | 1 | 1 | 1 | 20,709 |
| **Total Dist. 5** | 2,896 | 3,081 | 3,055 | 2,990 | 2,995 | 2,854 | 2,825 | 2,798 | 2,667 | 2,595 | 30,846,907 |
| **U.S. total** | 7,675 | 8,140 | 8,349 | 8,680 | 8,971 | 8,879 | 8,688 | 8,649 | 8,572 | 8,597 | 152,176,570 |

(s) Less than 500 b/d.

*Preliminary. †Includes Missouri, South Dakota, and Tennessee. §Includes Arizona and Washington.

# Supply and demand for crude in the U.S.

| | *1989 | 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | | | | | |
| SUPPLY | | | | | | | | | | |
| Crude imports† | 5,878 | 5,107 | 4,674 | 4,178 | 3,201 | 3,426 | 3,330 | 3,488 | 4,396 | 5,263 |
| Crude production | 7,675 | 8,140 | 8,349 | 8,680 | 8,971 | 8,879 | 8,688 | 8,649 | 8,572 | 8,597 |
| Unaccounted for crude | 150 | 196 | 145 | 139 | 145 | 185 | 114 | 71 | 83 | 93 |
| **Total supply** | 13,703 | 13,443 | 13,168 | 12,997 | 12,317 | 12,490 | 12,132 | 12,208 | 13,051 | 13,953 |
| DEMAND | | | | | | | | | | |
| Crude refinery runs | 13,405 | 13,246 | 12,854 | 12,716 | 12,002 | 12,044 | 11,685 | 11,774 | 12,470 | 13,481 |
| Crude used directly and loss | 25 | 40 | 34 | 49 | 61 | 65 | 66 | 62 | 63 | 28 |
| Crude exports | 130 | 155 | 151 | 154 | 204 | 181 | 164 | 236 | 228 | 287 |
| Crude into SPR | 58 | 51 | 73 | 48 | 118 | 195 | 234 | 175 | 336 | 45 |
| **Total demand** | 13,618 | 13,492 | 13,112 | 12,967 | 12,385 | 12,485 | 12,149 | 12,247 | 13,097 | 13,841 |
| Crude stock change (industry) | 85 | −49 | 56 | 30 | −68 | 5 | −17 | −39 | −46 | 112 |
| **Crude stocks (million bbl)** | | | | | | | | | | |
| Primary (industry)§ | 340 | 330 | 349 | 331 | 320 | 345 | 343 | 350 | 363 | 380 |
| SPR | 581 | 560 | 541 | 512 | 493 | 450 | 379 | 294 | 230 | 108 |

*Preliminary. †Includes imports for the Strategic Petroleum Reserve. §Includes Alaskan crude in transit as of 1980.

## *Crude imports by country of origin**

| | †1989 | 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | | | | | |
| Algeria§ | 60 | 58 | 115 | 78 | 84 | 195 | 176 | 90 | 261 | 456 |
| Angola | 262 | 203 | 180 | 102 | 104 | 85 | 71 | 42 | 45 | 37 |
| Australia | 28 | 59 | 49 | 30 | 21 | 25 | 0 | 0 | 0 | 0 |
| Canada | 623 | 681 | 608 | 570 | 468 | 341 | 274 | 214 | 164 | 199 |
| China | 74 | 82 | 63 | 68 | 36 | 15 | 6 | 8 | 0 | 0 |
| Colombia | 131 | 106 | 115 | 57 | 0 | 0 | 0 | 0 | 0 | 0 |
| Congo | 10 | 29 | 16 | 20 | 16 | 33 | 18 | 1 | 3 | 7 |
| Ecuador§ | 88 | 33 | 23 | 64 | 56 | 47 | 56 | 32 | 38 | 17 |
| Gabon§ | 42 | 15 | 35 | 25 | 51 | 57 | 59 | 40 | 35 | 25 |
| Indonesia§ | 151 | 186 | 262 | 297 | 292 | 304 | 315 | 226 | 318 | 314 |
| Iran§ | 0 | 0 | 98 | 19 | 27 | 10 | 48 | 35 | 9 | 8 |
| Iraq§ | 442 | 343 | 82 | 81 | 46 | 12 | 10 | 3 | 0 | 28 |
| Kuwait§ | 159 | 80 | 70 | 28 | 4 | 24 | 7 | 2 | 0 | 27 |
| Libya§ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 317 | 548 |
| Malaysia | 35 | 19 | 12 | 11 | 1 | 0 | 3 | 18 | 33 | 61 |
| Mexico | 726 | 674 | 602 | 621 | 715 | 659 | 766 | 645 | 469 | 507 |
| Nigeria§ | 797 | 607 | 529 | 437 | 280 | 207 | 301 | 510 | 611 | 841 |
| Norway | 131 | 62 | 70 | 53 | 31 | 112 | 65 | 102 | 114 | 144 |
| Oman | 22 | 7 | 35 | 8 | 2 | 10 | 34 | 22 | 24 | 24 |
| Saudi Arabia§ | 1,119 | 902 | 642 | 618 | 132 | 309 | 321 | 530 | 1,112 | 1,250 |
| Trinidad & Tobago | 77 | 71 | 75 | 93 | 98 | 87 | 83 | 92 | 102 | 115 |
| United Arab Emirates§ | 27 | 23 | 56 | 38 | 35 | 90 | 18 | 81 | 77 | 172 |
| United Kingdom | 170 | 254 | 304 | 317 | 278 | 378 | 365 | 441 | 369 | 173 |
| Venezuela§ | 470 | 439 | 488 | 416 | 306 | 253 | 164 | 155 | 147 | 156 |
| Zaire | 29 | 31 | 22 | 26 | 34 | 31 | 22 | 19 | 16 | 13 |
| Others | 205 | 142 | 123 | 102 | 85 | 141 | 146 | 158 | 140 | 141 |
| **Total imports** | 5,878 | **5,107** | **4,674** | **4,178** | **3,201** | **3,426** | **3,329** | **3,488** | **4,396** | **5,263** |
| **Total from OPEC** | 3,355 | **2,686** | **2,400** | **2,113** | **1,320** | **1,512** | **1,477** | **1,696** | **2,922** | **3,864** |

*Includes imports for the Strategic Petroleum Reserve. †Preliminary. §OPEC member.

## *Imports of refined products*

| | *1989 | 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | | | | | |
| Gasoline | 419 | 405 | 384 | 326 | 381 | 299 | 247 | 197 | 157 | 140 |
| Kerosine | 5 | 16 | 17 | 13 | 8 | 12 | 11 | 13 | 7 | 10 |
| Jet fuel-kerosine | 103 | 87 | 64 | 48 | 30 | 47 | 29 | 23 | 31 | 49 |
| Jet fuel-naphtha | 4 | 3 | 3 | 9 | 9 | 14 | 1 | 5 | 7 | 31 |
| Distillate | 305 | 302 | 255 | 247 | 200 | 272 | 174 | 93 | 173 | 142 |
| Residual | 623 | 644 | 565 | 669 | 510 | 682 | 699 | 776 | 800 | 941 |
| Unfinished oils | 361 | 360 | 299 | 250 | 318 | 231 | 234 | 174 | 112 | 55 |
| Other† | 360 | 479 | 417 | 483 | 411 | 459 | 327 | 344 | 312 | 283 |
| **Total U.S.** | 2,180 | **2,295** | **2,004** | **2,045** | **1,866** | **2,016** | **1,722** | **1,625** | **1,599** | **1,651** |

*Preliminary. †Includes plant condensate.

## *Exports of refined products and crude*

| | *1989 | 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | | | | | |
| Gasoline | 43 | 22 | 35 | 33 | 10 | 6 | 10 | 20 | 2 | 1 |
| Distillate | 91 | 69 | 66 | 100 | 67 | 51 | 64 | 74 | 5 | 3 |
| Residual | 199 | 200 | 186 | 147 | 197 | 191 | 185 | 209 | 118 | 34 |
| Lubricants | 18 | 26 | 23 | 23 | 15 | 15 | 16 | 16 | 19 | 23 |
| Coke | 234 | 231 | 213 | 238 | 187 | 194 | 195 | 156 | 138 | 137 |
| Asphalt and road oil | 4 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | — | 1 |
| LPG | 36 | 49 | 38 | 42 | 62 | 48 | 73 | 65 | 42 | 21 |
| Other refined products | 75 | 63 | 51 | 47 | 38 | 36 | 31 | 38 | 43 | 39 |
| Total refined products | 700 | 660 | 613 | 631 | 577 | 542 | 575 | 579 | 367 | 259 |
| Crude | 130 | 155 | 151 | 154 | 204 | 181 | 164 | 236 | 228 | 287 |
| **Total exports** | 830 | **818** | **764** | **785** | **781** | **723** | **739** | **815** | **595** | **546** |

*Preliminary.

Mainly due to high prices, U.S. demand for petroleum products fell for 5 consecutive years from the record high of 18.847 million b/d in 1978 to 15.231 million b/d in 1983. From 1983 through 1989 demand moved back up 2.079 million b/d, recapturing 57.5% of the loss.

Conservation and increased efficiency have reduced the amount of oil energy consumed per unit of economic growth. The ratio fell from 12,545 BTU/$ of GNP in 1977 to 8,280 BTU/$ in 1989—a drop of 34%. It is expected to slide further in 1990 to 8,200 BTU/$.

### Gasoline demand to grow

OGJ projects a slight increase in gasoline demand in 1990 to 7.375 million b/d. That's based on an increase in the number of vehicles, a slowdown in the improvement in vehicle fuel efficiency, and stagnant pump prices.

Demand for motor gasoline in 1989 averaged an estimated 7.335 million b/d vs. 7.336 million b/d the year before.

Continued improvement in vehicle fuel efficiency and higher gasoline prices were the major reasons for last year's slowing of demand. The 8.1% jump in average

Fig. 1

## Crude output will continue to decline

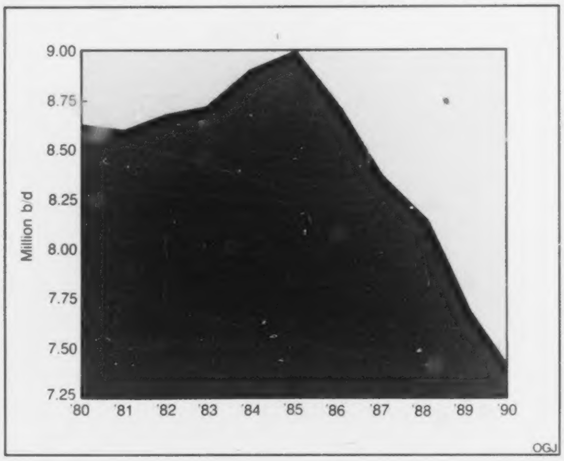


Fig. 2

## Gasoline demand will increase

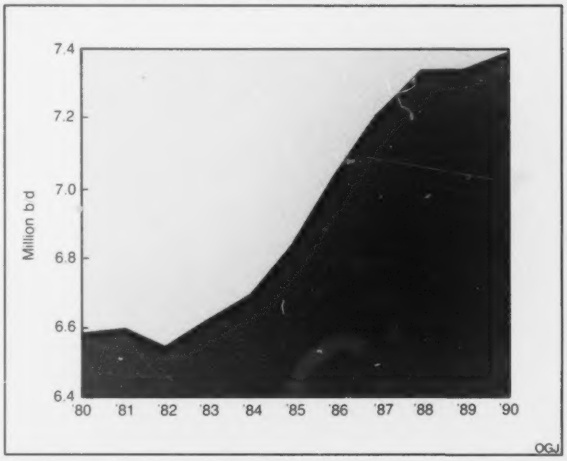


Fig. 3

## Crude imports continue upward

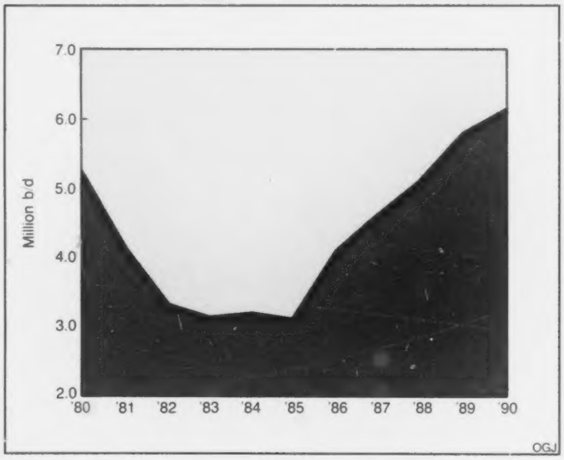


Fig. 4

## Distillate demand up marginally

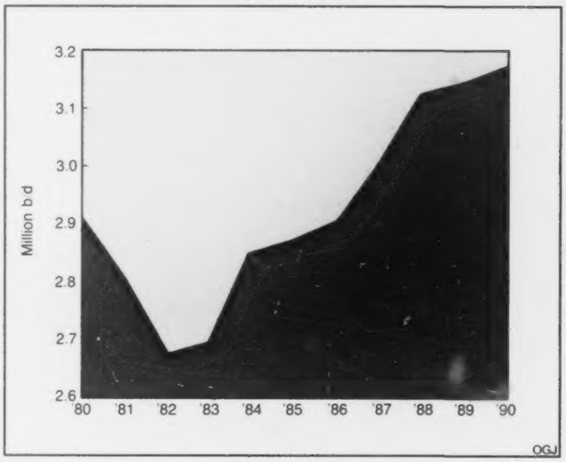


Fig. 5

## Rig activity will start upward

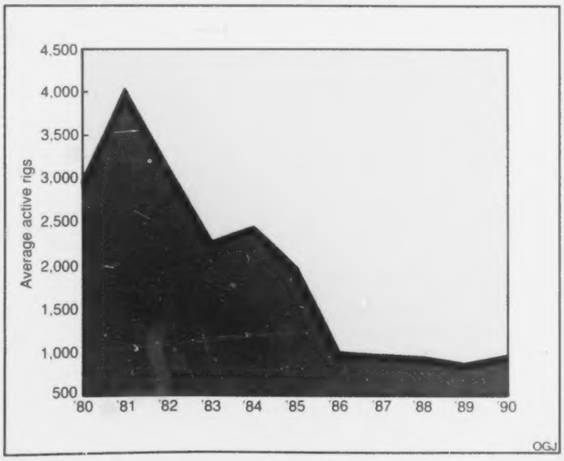
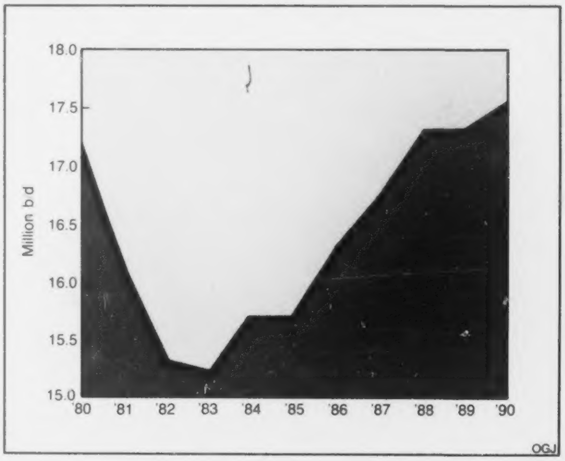


Fig. 6

## Total demand will resume climb



## Refinery runs by districts

| | 1989 Crude runs* 1,000 b/d | 1989 Input to crude stills* 1,000 b/d | 1989 % of operable capacity | Crude runs 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1,000 b/d | | | | | | | | |
| East Coast | 1,266 | 1,268 | 95.0 | 1,198 | 1,153 | 1,122 | 1,061 | 1,019 | 960 | 1,103 | 1,202 | 1,300 |
| Appalachian Dist. 1 | 87 | 90 | 72.8 | 100 | 98 | 101 | 92 | 87 | 77 | 93 | 132 | 158 |
| **Total Dist. 1** | **1,353** | **1,358** | **93.1** | **1,298** | **1,251** | **1,223** | **1,153** | **1,106** | **1,037** | **1,196** | **1,334** | **1,458** |
| Ill., Ind., Ky.† | 1,952 | 1,963 | 89.8 | 1,944 | 1,929 | 1,901 | 1,837 | 1,842 | 1,851 | 1,765 | 1,857 | 2,121 |
| Minn., Wisc., Daks.<br>238 | 301 | 305 | 89.5 | 307 | 287 | 294 | 285 | 282 | 253 | 251 | 229 | 238 |
| Okla., Kan., Mo. | 679 | 685 | 93.5 | 665 | 627 | 627 | 617 | 636 | 642 | 763 | 883 | 945 |
| **Total Dist. 2** | **2,932** | **2,953** | **90.6** | **2,916** | **2,844** | **2,822** | **2,739** | **2,760** | **2,746** | **2,779** | **2,969** | **3,304** |
| Texas: | | | | | | | | | | | | |
| Inland | 505 | 510 | 91.7 | 480 | 470 | 472 | 472 | 499 | 474 | 456 | 469 | 445 |
| Gulf Coast | 3,087 | 3,109 | 88.4 | 3,021 | 2,909 | 2,990 | 2,750 | 2,780 | 2,801 | 2,726 | 2,829 | 3,151 |
| Louisiana Gulf | 2,255 | 2,257 | 76.7 | 2,261 | 2,229 | 2,162 | 1,972 | 2,012 | 1,862 | 1,941 | 2,030 | 2,091 |
| N. La., Ark. | 162 | 165 | 64.9 | 176 | 164 | 170 | 168 | 177 | 170 | 162 | 163 | 186 |
| New Mexico | 71 | 73 | 96.4 | 69 | 66 | 63 | 60 | 68 | 75 | 77 | 81 | 87 |
| **Total Dist. 3** | **6,080** | **6,114** | **83.3** | **6,008** | **5,839** | **5,857** | **5,422** | **5,536** | **5,382** | **5,362** | **5,572** | **5,960** |
| **Total Dist. 4** | **481** | **486** | **88.0** | **452** | **437** | **431** | **432** | **436** | **420** | **416** | **425** | **442** |
| **Total Dist. 5** | **2,559** | **2,669** | **87.6** | **2,573** | **2,483** | **2,383** | **2,256** | **2,206** | **2,100** | **2,021** | **2,171** | **2,354** |
| **Total U.S.** | **13,405** | **13,580** | **86.7** | **13,246** | **12,854** | **12,715** | **12,002** | **12,044** | **11,685** | **11,774** | **12,471** | **13,518** |

*Preliminary. † Includes Appalachian Dist. 2

## U.S. refined products, natural gas liquids, and crude stocks

| | *1989 | 1988 | 1987 | 1986 | 1985 | 1984 | 1983 | 1982§ | 1981 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1,000 bbl | | | | | | | | |
| Gasoline ........................ | 225,200 | 230,521 | 228,514 | 235,490 | 225,148 | 246,307 | 225,042 | 247,085 | 256,425 | 264,011 |
| Motor† ........................ | 223,100 | 228,403 | 226,183 | 233,057 | 222,839 | 243,296 | 222,434 | 244,279 | 253,001 | 261,327 |
| Aviation† .................... | 2,100 | 2,118 | 2,331 | 2,433 | 2,309 | 3,011 | 2,608 | 2,806 | 3,424 | 2,684 |
| Special naphthas........... | 3,500 | 3,487 | 3,654 | 3,759 | 3,909 | 2,951 | 3,153 | 3,474 | 3,965 | 4,929 |
| Kerosine ........................ | 7,300 | 7,284 | 8,447 | 8,379 | 7,502 | 11,893 | 7,861 | 10,792 | 11,042 | 11,568 |
| Distillate ........................ | 112,600 | 123,517 | 134,485 | 155,097 | 143,673 | 161,072 | 140,263 | 185,579 | 191,541 | 205,113 |
| Residual.......................... | 42,100 | 44,621 | 47,410 | 47,437 | 50,381 | 53,000 | 48,504 | 68,229 | 77,992 | 91,786 |
| Kerosine jet fuel............ | 39,500 | 37,723 | 41,973 | 42,677 | 33,825 | 35,118 | 32,346 | 32,001 | 34,011 | 35,723 |
| Naphtha jet fuel ............ | 6,100 | 6,051 | 7,956 | 7,072 | 7,502 | 6,861 | 6,265 | 7,189 | 7,054 | 6,308 |
| Natural gas liquids & LRG | 108,200 | 103,988 | 104,119 | 109,532 | 81,707 | 108,446 | 116,817 | 114,497 | 150,170 | 137,460 |
| Unfinished oils............... | 106,100 | 99,858 | 93,185 | 94,022 | 106,656 | 93,506 | 108,018 | 105,277 | 111,348 | 123,938 |
| Other refined products... | 49,400 | 50,308 | 48,065 | 46,258 | 44,258 | 41,192 | 42,429 | 44,023 | 46,295 | 45,426 |
| **Total products stocks .** | **700,000** | **707,358** | **717,808** | **749,723** | **704,561** | **760,346** | **730,698** | **818,146** | **889,843** | **926,262** |
| **Crude stocks (ex. SPR)** | **340,000** | **340,000** | **348,995** | **331,224** | **320,892** | **345,376** | **343,850** | **350,044** | **363,464** | **358,166** |
| **Total stocks (ex. SPR)** | **1,040,000** | **1,047,358** | **1,066,803** | **1,080,947** | **1,025,453** | **1,105,722** | **1,074,548** | **1,168,190** | **1,253,307** | **1,284,428** |
| **SPR stocks...............** | **581,000** | **559,515** | **540,648** | **511,565** | **493,316** | **450,505** | **379,089** | **293,827** | **230,341** | **107,800** |
| **Total stocks (incl. SPR).......................** | **1,621,000** | **1,606,873** | **1,607,451** | **1,592,512** | **1,518,769** | **1,556,227** | **1,453,637** | **1,462,017** | **1,483,648** | **1,392,228** |

*Preliminary. †Includes blending components. §Change in Energy Information Administration reporting basis.

pump price for unleaded gasoline last year, for example, was almost twice the inflation rate and encouraged some conservation.

Gasoline demand this year will be second only to the record 7.412 million b/d of 1978, the level from which efficiency improvements and price-induced conservation steadily drove consumption down to 6.539 million b/d in 1982.

Until last year, gasoline demand had been climbing again despite continued improvements in vehicle fuel efficiency. Increases in fleet size and vehicle use offset the efficiency gains.

Average distance driven per unit of fuel rose steadily from 13.3 mpg in 1973 to 19.95 mpg in 1988. Average distance driven per car increased from 9,141 miles in 1980 to 10,119 miles in 1988. The number of automobiles registered moved up from 121.6 million in 1980 to 140.7 million in 1988.

Also stimulating gasoline demand through 1988 were a drop in pump prices—the average in 1988 was 28.8% below the peak in 1981—and the increase in the interstate highway speed limit to 65 mph, estimated to have added 90,000 b/d to consumption.

### Jet fuel, distillate

U.S. demand for jet fuel will climb 2.6% in 1990 to 1.525 million b/d. This is the same rate of increase as in 1989, when demand averaged 1.487 million b/d.

Most of the growth will be in demand for kerosine jet fuel for commercial aircraft, expected to move up 33,000 b/d to 1.31 million b/d. This 2.6% increase compares with a 3.3% increase last year.

Total available seat miles flown by U.S. scheduled airlines was up an estimated 0.9% during the first 11 months last year. Domestic seat-miles were down 1.6%, but international seat-miles were up 10.3%. Air freight revenue-ton-miles for the first 10 months of 1989 were up 6.5% from the year before.

Increased fuel demand in 1990 will be due to continued gains in miles flown, particularly air freight.

Demand for naphtha jet fuel for military jets is expected to be up 5,000 b/d in 1990 at 210,000 b/d. There has been little change in consumption of military jet fuel for several years.

Economic activity in 1990 will boost demand for distillate 0.9% to 3.165 million b/d. Most of the increase will be in demand for highway diesel fuel. Truck freight will move up along with economic activity. With normal weather, residential and commercial demand will also be up in 1990. Weak prices will slow conservation and conversion to other fuels. These increases will be somewhat offset by slightly weaker demand for industry, farms, and railroads.

Distillate demand in 1989 was up only 0.5% at 3.138 million b/d. Growth was slowed by higher prices, with the average wholesale price of No. 2 fuel oil up 11.6%.

### Resid, other products

The competitive position of residual fuel oil will improve in 1990 due to somewhat weaker prices. OGJ projects a 3.4% resid demand increase to 1.385 million b/d.

Electric utility and industrial demand will rise in 1990. Continued growth in electrical power consumption will raise utility energy needs, part of which will be supplied by residual fuel oil.

Last year resid demand fell 2.8% to 1.34 million b/d. Resid lost market share to natural gas, particularly in the industrial sector, because of price gains. A rebound in hydroelectric output also reduced potential demand for fuel oil by utilities. Resid prices were up an estimated 13.5% from the previous year.

Demand for LPG and ethane will climb 0.9% in 1990 to 1.675 million b/d. Last year, demand was up 0.2% at 1.66 million b/d. Demand for petrochemical feedstocks is expected to continue to grow due to increased economic activity. Demand for LPG as a fuel also will increase.

Demand for all other products will gain 1.1% in 1990 to 2.375 million b/d. Last year demand moved up 0.3%. The largest increases will be in demand for asphalt and road oil, and for petrochemical feedstocks. This category now represents 13.6% of total domestic demand for petroleum products.

### Gas demand growing

The modest natural gas demand gain expected this year will occur in the industrial and residential-commercial sectors.

Those sectors accounted for last year's demand increase to an estimated 18.345 tcf from 18.028 tcf in 1988. Electric utility demand dropped last year because of the resurgence of hydro power.

This year, natural gas again will face stiff competition in the utility sector. Hydroelectric power will rise again, and resid price weakness will mean additional competition from oil.

The overall gas demand rebound will continue nevertheless. Consumption of gas fell from 20.241 tcf in 1979 to 16.221 tcf in 1986 due to gas price increases and competition from other fuels. Demand this year will be up 2.289 tcf from 1986, meaning that about 57% of the 1979-86 decline will have been recovered.

U.S. gas production hasn't gained back nearly as much. Output expected this year—17.91 tcf—represents only a 6.7% increase from the 1986 level, which contrasts with the 14.1% demand increase.

Last year marketed production fell 0.2% to 17.78 tcf.

Imports, mainly from Canada, have been rising rapidly to meet the increase in demand. They climbed 5.5% last year to a total of 1.365 tcf. LNG imports from Algeria accounted for 36 bcf; the remaining 1.329 tcf was from Canada. This year's expected import total includes 40 bcf of LNG from Algeria and 1.46 tcf from Canada.

The average wellhead price of gas rose to $1.70/Mcf last year from $1.69/Mcf in 1988. Prices will rise only slightly this year to $1.70-1.75/Mcf.

Gas prices didn't peak until 3 years after crude oil prices—at $2.66/Mcf in 1984—and then did not fall as rapidly when oil prices plummeted, falling to $1.67/Mcf in 1987. ▪

# *Oil & Gas Journal well forecast for 1990*

| State | 1989 estimate |  |  | 1990 forecast |  |  |  |
|---|---|---|---|---|---|---|---|
|  | Total Wells | Total wildcats | Total footage (1,000 ft) | Total wells | Total wildcats | Field wells | Total footage (1,000 ft) |
| Alabama | 698 | 94 | 1,853 | 725 | 100 | 625 | 1,925 |
| Alaska | 145 | 15 | 1,451 | 160 | 25 | 135 | 1,601 |
| Arizona | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| Arkansas | 313 | 40 | 1,369 | 340 | 50 | 290 | 1,492 |
| California | 1,600 | 130 | 4,370 | 1,700 | 185 | 1,515 | 4,644 |
| Colorado | 800 | 260 | 4,384 | 860 | 280 | 580 | 4,713 |
| Florida | 15 | 10 | 227 | 15 | 10 | 5 | 227 |
| Illinois | 1,251 | 427 | 2,484 | 1,200 | 400 | 800 | 2,500 |
| Indiana | 1,600 | 90 | 2,765 | 1,600 | 90 | 1,510 | 2,765 |
| Iowa | 10 | 10 | 13 | 10 | 10 | 0 | 13 |
| Kansas | 2,250 | 872 | 7,000 | 2,400 | 950 | 1,450 | 7,212 |
| Kentucky | 2,500 | 375 | 3,862 | 2,600 | 400 | 2,200 | 4,607 |
| Louisiana | 1,880 | 325 | 16,244 | 2,020 | 395 | 1,625 | 17,394 |
| North | 700 | 120 | 3,300 | 760 | 145 | 615 | 3,583 |
| South | 500 | 80 | 5,526 | 560 | 100 | 460 | 6,174 |
| Offshore | 630 | 125 | 7,418 | 700 | 150 | 550 | 7,637 |
| Michigan | 784 | 180 | 2,783 | 800 | 200 | 600 | 2,840 |
| Mississippi | 280 | 130 | 2,372 | 300 | 150 | 150 | 2,636 |
| Missouri | 9 | 8 | 27 | 9 | 8 | 1 | 27 |
| Montana | 225 | 75 | 750 | 225 | 75 | 150 | 750 |
| Nebraska | 100 | 62 | 524 | 100 | 62 | 38 | 524 |
| Nevada | 20 | 20 | 100 | 30 | 28 | 2 | 150 |
| New Mexico | 900 | 90 | 4,583 | 800 | 120 | 680 | 4,073 |
| New York | 300 | 15 | 908 | 300 | 15 | 285 | 908 |
| North Dakota | 165 | 80 | 1,424 | 180 | 100 | 80 | 1,554 |
| Ohio | 1,700 | 45 | 6,843 | 1,700 | 45 | 1,655 | 6,843 |
| Oklahoma | 2,625 | 220 | 13,650 | 3,000 | 250 | 2,750 | 15,600 |
| Oregon | 13 | 8 | 30 | 13 | 8 | 5 | 30 |
| Pennsylvania | 1,032 | 55 | 4,330 | 900 | 50 | 850 | 3,775 |
| South Dakota | 10 | 8 | 43 | 10 | 8 | 2 | 43 |
| Tennessee | 69 | 18 | 101 | 80 | 20 | 60 | 123 |
| Texas | 7,129 | 1,715 | 39,408 | 8,098 | 1,990 | 6,108 | 44,145 |
| District 1 | 720 | 100 | 2,190 | 640 | 100 | 540 | 1,946 |
| District 2 | 416 | 150 | 2,582 | 450 | 200 | 250 | 2,792 |
| District 3 | 620 | 225 | 4,592 | 450 | 250 | 200 | 3,332 |
| District 4 | 590 | 200 | 4,640 | 650 | 225 | 425 | 5,112 |
| District 5 | 190 | 60 | 1,117 | 200 | 75 | 125 | 1,176 |
| District 6 | 550 | 85 | 4,306 | 600 | 100 | 500 | 4,273 |
| District 7-B | 1,221 | 255 | 3,545 | 1,198 | 270 | 928 | 3,477 |
| District 7-C | 621 | 155 | 3,399 | 700 | 200 | 500 | 3,831 |
| District 8 | 803 | 80 | 4,910 | 1,060 | 100 | 960 | 6,481 |
| District 8-A | 380 | 120 | 2,224 | 600 | 130 | 470 | 3,512 |
| District 9 | 518 | 185 | 1,888 | 980 | 200 | 780 | 3,571 |
| District 10 | 300 | 35 | 2,050 | 320 | 40 | 280 | 2,186 |
| Offshore | 200 | 65 | 1,965 | 250 | 100 | 150 | 2,456 |
| Utah | 100 | 35 | 565 | 110 | 40 | 70 | 621 |
| Virginia | 11 | 2 | 57 | 11 | 2 | 9 | 57 |
| Washington | 3 | 3 | 34 | 3 | 3 | 0 | 34 |
| West Virginia | 718 | 15 | 3,143 | 800 | 20 | 780 | 3,502 |
| Wyoming | 544 | 200 | 4,236 | 600 | 225 | 375 | 4,113 |
| **Total** | **29,800** | **5,633** | **131,934** | **31,700** | **6,315** | **25,385** | **141,442** |
| Western Canada | 5,363 | 2,340 | 20,387 | 5,620 | 2,437 | 3,183 | 21,351 |
| Alberta | 3,600 | 1,825 | 15,203 | 3,700 | 1,900 | 1,800 | 15,625 |
| Saskatchewan | 1,500 | 416 | 3,771 | 1,600 | 420 | 1,180 | 4,022 |
| British Columbia | 212 | 90 | 1,256 | 250 | 100 | 150 | 1,481 |
| Manitoba | 45 | 6 | 117 | 60 | 12 | 48 | 157 |
| North—arctic | 6 | 3 | 40 | 10 | 5 | 5 | 66 |
| East Coast offshore | 3 | 2 | 35 | 3 | 2 | 1 | 35 |

## A 26 year record of U.S. well completions

| Year | Total wells | Total footage | Total wildcats |
|---|---|---|---|
| 1989* | 29,800 | 131,934,000 | 5,633 |
| 1988 | 31,168 | 150,997,000 | 6,140 |
| 1987 | 35,232 | 161,530,000 | 6,715 |
| 1986 | 39,015 | 177,641,000 | 7,156 |
| 1985 | 70,806 | 316,778,000 | 12,208 |
| 1984 | 84,983 | 368,796,000 | 15,138 |
| 1983 | 75,738 | 316,617,464 | 13,845 |
| 1982 | 83,889 | 375,382,919 | 15,882 |
| 1981 | 89,234 | 406,520,453 | 17,430 |
| 1980 | 69,486 | 311,444,837 | 12,870 |
| 1979 | 51,890 | 243,685,430 | 10,735 |
| 1978 | 50,061 | 238,386,248 | 11,030 |
| 1977 | 45,855 | 215,695,878 | 10,140 |
| 1976 | 40,940 | 187,289,586 | 9,317 |
| 1975 | 38,884 | 181,039,393 | 9,459 |
| 1974 | 33,037 | 153,776,399 | 8,969 |
| 1973 | 27,692 | 139,424,738 | 7,771 |
| 1972 | 27,934 | 138,796,562 | 7,551 |
| 1971 | 26,268 | 127,255,952 | 7,131 |
| 1970 | 28,173 | 138,559,527 | 7,436 |
| 1969 | 32,187 | 157,107,859 | 9,701 |
| 1968 | 30,559 | 144,970,447 | 8,879 |
| 1967 | 32,234 | 141,356,463 | 8,878 |
| 1966 | 36,384 | 162,445,209 | 10,313 |
| 1965 | 39,501 | 181,427,015 | 9,466 |
| 1964 | 42,963 | 189,921,870 | 10,747 |

*Estimated.

Another busy area this year will be the Black Warrior basin of northeastern Mississippi and northwestern Alabama. Ladd Petroleum Corp. recently completed 1 Sanders 18-6, SE NW 18-17s-12w, Fayette County, Ala., flowing 396 Mcfd of gas and 260 b/d of oil from Carter sand. And Pacific Enterprises Oil Co. 1 Grace in Pickens County, Ala., flowed 1.356 MMcfd of gas and 49 b/d of oil from the Lewis sand.

There will be 300 wells drilled in Mississippi this year.

Cretaceous Hosston gas-condensate production is a key objective in the state. Oryx Energy Co. recently reported a discovery in Jones County. Its 1 Smith flowed was 4.4 MMcfd of gas and 1,224 b/d of condendsate from 15,906-938 ft. The well is on the south flank of the Centerville salt dome. There continue to be Cretaceous Rodessa gas-condensate discoveries in Mississippi as well as lower Tuscaloosa oil finds in Wilkinson County.

### Oklahoma revives

Oklahoma activity has revived with exploration of the Cambro-Ordovician Arbuckle limestone and Pennsylvanian gas sands in southeastern parts of the state. An Arbuckle trend is shaping up from Mayfield on the northwest, through the Alden field area, then into Cottonwood Creek oil field in the Ardmore-Marietta basin of Carter County.

There is a brisk gas campaign in southeastern Oklahoma's Arkoma basin where ARCO just completed the 12th Arbuckle gas well under Wilburton field. Flow was 34.7 MMcfd of gas from 13,900 ft. This is part of a play that eclipses anything yet in the Arkoma basin. Another big find was Amoco 1 Scott Unit in Southwest Haileyville field, Pittsburg County, where flow was 18 MMcfd of gas from an unidentified zone below 6,100 ft, certainly Pennsylvanian in age.

In the past year, Amoco Production Co. has completed important wildcats and outposts on the Ouachita Thrust Belt: the 1 Zipperer, Pittsburg County, the 1 Garrett Unit "A", Pittsburg County, and the 1 Patterson, Latimer County. These wells flow a combined 82 MMcfd of gas from Pennsylvanian sands as deep as 13,200 ft.

Oklahoma operators plan to drill 3,000 wells this year.

### Texas, Louisiana

Operators, mainly on the basis of oil and natural gas price expectations, plan to steadily boost exploration and development in the Gulf of Mexico.

There was a big increase in leasing activity, particularly by independents, during the 1988-89 area-wide lease sales in the gulf. Companies say they plan to drill much of this new acreage as soon as possible. Operators plan 700 wells off Louisiana this year, 250 off Texas. Both are increases.

Gas prospects are receiving most of the near term action in the gulf. Also fueling activity are large volumes of speculative 3D seismic data shot by contractors and acquired by lessees.

## The majors' score

| State | Forecast<br>Total wells 1990 | Forecast<br>Wildcats 1990 | Wells drilled<br>Total wells 1989 | Wells drilled<br>Wildcats 1989 |
|---|---|---|---|---|
| Alabama | 191 | 6 | 169 | 15 |
| Alaska | 160 | 25 | 145 | 15 |
| Arkansas | 17 | 9 | 5 | 3 |
| California | 1,604 | 54 | 1,489 | 19 |
| Colorado | 290 | 8 | 192 | 6 |
| Florida | 2 | 0 | 5 | 4 |
| Illinois | 136 | 3 | 103 | 3 |
| Kansas | 133 | 10 | 135 | 4 |
| Louisiana | 607 | 183 | 516 | 134 |
| North | 32 | 2 | 69 | 1 |
| South | 195 | 61 | 121 | 30 |
| Offshore | 380 | 120 | 326 | 103 |
| Michigan | 91 | 34 | 91 | 30 |
| Mississippi | 19 | 11 | 12 | 9 |
| Montana | 22 | 5 | 12 | 6 |
| Nebraska | 2 | 0 | 6 | 1 |
| Nevada | 6 | 6 | 4 | 4 |
| New Mexico | 247 | 60 | 242 | 28 |
| North Dakota | 26 | 9 | 16 | 4 |
| Oklahoma | 247 | 46 | 145 | 26 |
| Oregon | 0 | 0 | 8 | 8 |
| Pennsylvania | 100 | 0 | 90 | 0 |
| Texas | 1,342 | 170 | 1,238 | 114 |
| South | 232 | 69 | 120 | 28 |
| Offshore | 31 | 47 | 69 | 31 |
| East | 98 | 5 | 110 | 7 |
| West | 890 | 46 | 905 | 43 |
| North | 13 | 0 | 4 | 1 |
| Panhandle | 28 | 3 | 30 | 4 |
| Utah | 12 | 3 | 25 | 13 |
| Virginia | 2 | 0 | 3 | 1 |
| Washington | 0 | 0 | 1 | 1 |
| West Virginia | 8 | 1 | 4 | 1 |
| Wyoming | 206 | 20 | 159 | 22 |
| Total U.S. | 5,470 | 663 | 4,815 | 471 |

BP Exploration will spend $250 million on a Gulf of Mexico project in near record water depths. It will develop Mississippi Canyon Blocks 109 and 110 in 1,030 ft of water.

Onshore, deep drilling is under way along the Texas Gulf Coast in Wharton County.

ARCO plans a 14,000 ft wildcat 2 miles northeast of Hungerford field at 1 Ansley.

Operators plan fewer wells in District 3 this year, but statewide the total will climb considerably from 1988 to 8,098 wells.

A new Mississippian oil discovery was completed in Stephens County, West Central Texas, at Tex-Ann 1 Clark, 4 miles west of Crystal Falls, flowing 148 b/d of oil. Operators plan 1,198 wells this year in District 7-B and 700 in District 7-C.

They plan 1,060 wells in District 8 and 600 in District 8-A in West Texas, where Texaco Inc. completed a southwest extension in Glasscock County, flowing 433 b/d of oil.

There's a new gas field in southeastern Louisiana's West Feliciana Parish. The Florida Parishes find is Griffin & Griffin 1 Spillman, 47-1s-2w. Flow was 1.598 MMcfd of gas and 246 b/d of condensate from Cretaceous lower Tuscaloosa at 13,928-932 ft.

The middle Eocene Sparta formation is an important wildcat target in South Central Louisiana's Eocene-Oligocene trend.

Cumulative production from 20 multiple pay fields in this trend exceeds 269 million bbl of oil, 50 million bbl of condensate, and 1.5 bcf of gas.

Operators in South Louisiana expect to drill 560 wells this year.

### Other areas

Michigan, where industry plans to drill 800 wells this year, has another deep gas discovery.

PetroStar and Elf Aquitaine extended Cambro-Ordovician Prairie du Chien gas production to the northwest in Missaukee County.

The 1-15 Riverside flowed 2.7 MMcfd of gas and some water. Total depth is 11,972 ft, the fourth deep well in the county.

In the Rocky Mountains, Wyoming's Wamsutter Arch is the scene for an Amoco discovery in Sweetwater County in the Greater Green River basin. The 1 Frewen Deep Unit flowed from the lower Cretaceous Lakota.

The state's largest basin, the Powder River, continues to tag new oil finds. The industry plans to drill more than 600 wells in the state this year, many of them in this basin.

Latest oil producer in Nevada's Kate Spring oil field is David M. Evans 2 Taylor-Federal in 3-8n-57e, Nye County.

The well was pumped for 268 b/d of oil from Devonian pay at 4,519-33 ft. The state continues to be a popular place for the wildcatter. The industry plans 30 wells in the state this year, 28 of them exploratory.

Deeper Paleozoic exploration continues to expand along the Colorado-Kansas line where several oil fields have been opened in recent months. Important new action is expected to increase in the Stockholm area. Kansas operators plan 2,400 wells this year, while Colorado will see 860 wells drilled, some in this new area, others in the Denver basin and in northwestern parts of the state.

In Canada, drilling is increasing in British Columbia. The industry drilled 212 wells in the western Canadian province last year and plans 250 in 1990.

Canadians believe the U.S. gas market will fuel a gradual increase in drilling.

Scurry-Rainbow may drill 32 wildcats in British Columbia this winter. Canadian Hunter devoted about half its $180 million 1989 capital budget to the province and accounts for almost one fourth of all wells completed in the region in 1989.

More than 1,100 gas and oil pools have been opened in northeastern B.C. to date. ▪

# *U.S. fields with reserves exceeding 100 million bbl*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| | | 1,000 bbl | | |

## *ALABAMA*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Citronelle, 1955 | 1,785 | 149,646 | 5,215 | 443 |

## *ALASKA*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Endicott, 1978 | 35,674 | 82,143 | 293,000 | 34 |
| Granite Point, 1965 | 2,362 | 111,866 | 17,000 | 27 |
| Kuparuk River, 1969 | 109,627 | 616,109 | 885,000 | 324 |
| Lisburne, 1967 | 13,192 | 49,401 | 161,000 | 53 |
| McArthur River, 1965 | 6,930 | 535,763 | 40,000 | 77 |
| Middle Ground Shoal, 1962 | 2,794 | 158,638 | 8,000 | 42 |
| Prudhoe Bay, 1968 | *503,751 | †6,733,212 | 3,185,000 | 724 |
| Swanson River, 1957 | 1,878 | 211,340 | 8,000 | 27 |

*Includes about 28.79 million bbl of condensate. †Includes about 167.27 million bbl of condensate.

## *ARKANSAS*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Smackover, 1922 | 2,772 | 559,679 | 8,000 | 2,100 |

## *CALIFORNIA*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| San Joaquin Valley | | | | |
| Belridge South, 1911 | 60,225 | 737,308 | 375,061 | 4,654 |
| Buena Vista, 1909 | 1,570 | 648,844 | 36,701 | 825 |
| Coalinga, 1890 | 10,220 | 764,065 | 150,968 | 2,131 |
| Coalinga Nose, 1938 | 1,095 | 499,780 | 8,334 | 77 |
| Coles Levee North, 1938 | 474 | 160,906 | 2,274 | 72 |
| Cuyama South, 1949 | 470 | 218,661 | 6,468 | 88 |
| Cymric,1909 | 9,811 | 209,119 | 85,221 | 1,029 |
| Edison, 1928 | 1,277 | 135,668 | 31,434 | 590 |
| Elk Hills, 1911 | 34,310 | 927,684 | 545,466 | 1,094 |
| Fruitvale, 1928 | 511 | 116,064 | 13,198 | 249 |
| Greeley, 1936 | 197 | 112,844 | 1,566 | 26 |
| Kern Front, 1912 | 1,460 | 174,526 | 53,770 | 798 |
| Kern River, 1899 | 48,545 | 1,253,024 | 694,455 | 6,565 |
| Kettleman North Dome, 1928 | 175 | 456,823 | 1,123 | 44 |
| Lost Hills, 1910 | 5,584 | 183,877 | 66,683 | 1,619 |
| McKittrick, 1896 | 2,403 | 269,225 | 88,516 | 823 |
| Midway-Sunset, 1894 | 59,458 | 1,938,805 | 314,405 | 9,252 |
| Mount Poso, 1926 | 6,205 | 269,455 | 73,075 | 460 |
| Rio Bravo, 1937 | 112 | 116,163 | 1,207 | 14 |
| Yowlumne, 1974 | 6,022 | 87,390 | 20,993 | 59 |
| Coastal Area | | | | |
| Carpinteria, 1966 | 2,205 | 90,306 | 27,084 | 118 |
| Cat Canyon E. & W., 1908 | 2,153 | 290,389 | 44,777 | 330 |
| Dos Cuadras, 1969 | 4,120 | 216,924 | 50,020 | 138 |
| Elwood, 1928 | 292 | 105,997 | 1,991 | 7 |
| Hondo, 1969 | 9,855 | 99,476 | 102,368 | 21 |
| Orcutt, 1901 | 794 | 166,668 | 9,444 | 124 |
| Point Pedernales, 1982 | 6,205 | 17,920 | 325,339 | 9 |
| Rincon, 1927 | 1,095 | 149,854 | 13,737 | 197 |
| San Ardo, 1947 | 3,577 | 411,928 | 119,326 | 491 |
| Santa Maria Valley, 1934 | 1,467 | 199,598 | 38,941 | 149 |
| South Mountain, 1916 | 693 | 146,677 | 11,342 | 360 |
| Ventura, 1919 | 6,793 | 901,535 | 90,233 | 470 |
| Los Angeles Basin | | | | |
| Beta, 1976 | 5,565 | 45,988 | 168,260 | 71 |
| Beverly Hills, 1900 | 1,825 | 124,441 | 40,531 | 106 |
| Brea Olinda, 1880 | 2,190 | 386,084 | 52,597 | 711 |
| Coyote East, 1909 | 547 | 109,210 | 12,665 | 99 |
| Coyote West, 1909 | 702 | 250,671 | 6,779 | 97 |
| Dominguez, 1923 | 584 | 269,850 | 6,864 | 113 |
| Huntington Beach, 1920 | 5,110 | 1,071,478 | 66,934 | 861 |
| Inglewood, 1924 | 2,701 | 348,154 | 51,448 | 288 |
| Long Beach, 1921 | 2,226 | 911,983 | 14,990 | 336 |
| Montebello, 1917 | 598 | 192,955 | 9,669 | 150 |
| Richfield, 1919 | 1,420 | 190,585 | 25,992 | 193 |
| Santa Fe Springs, 1919 | 971 | 614,048 | 8,065 | 154 |
| Seal Beach, 1924 | 777 | 203,895 | 13,341 | 166 |
| Torrance, 1922 | 1,515 | 213,598 | 34,332 | 284 |
| Wilmington, 1932 | 26,637 | 2,318,866 | 468,996 | 1,712 |

## *COLORADO**

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Rangely, 1933 | 12,340 | 751,704 | 35,000 | 469 |

## *FLORIDA*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Jay, 1970 | 4,765 | 365,377 | 51,179 | 62 |

## *ILLINOIS**

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Clay City, 1938 | 2,208 | 396,068 | 6,000 | 1,425 |
| Lawrence, 1906 | 2,820 | 397,341 | 5,000 | 23 |
| Louden, 1938 | 1,224 | 389,461 | 2,800 | 407 |
| Main, 1906 | 2,040 | 235,313 | 5,000 | 829 |
| New Harmony, 1938 | 948 | 154,493 | 3,800 | 389 |
| Salem, 1938 | 972 | 387,955 | 3,528 | 65 |

## *KANSAS**

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Bemis-Shutts, 1928 | 992 | 245,239 | 3,413 | 746 |
| Chase-Silica, 1931 | 919 | 302,958 | 3,580 | 999 |
| El Dorado, 1917 | 769 | 299,386 | 1,847 | 790 |
| Hall-Gurney, 1931 | 935 | 147,133 | 3,116 | 1,023 |
| Trapp, 1937 | 1,067 | 227,447 | 3,576 | 856 |

## *LOUISIANA*

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| Offshore | | | | |
| •Bay Marchand Blk. 2, 1949 | 9,300 | 606,272 | 50,000 | 483 |
| •Eugene Island Blk. 330, 1930 | 7,097 | 277,730 | 47,268 | 302 |
| •Grande Isle Blk. 16, 1948 | 3,612 | 267,341 | 82,033 | 143 |
| •Grande Isle Blk. 43, 1956 | 5,172 | 277,428 | 80,516 | 310 |
| •Mississippi Canyon Blk. 194, 1980 | 4,503 | 121,371 | 71,808 | 55 |
| •Main Pass Blk. 41, 1957 | 2,952 | 240,806 | 20,432 | 306 |
| •Main Pass Blk. 306, 1969 | 1,716 | 203,585 | 76,619 | 109 |
| •South Marsh Island Blk. 128, 1974 | — | 81,000 | 20,000 | 77 |
| •South Pass Blk. 27, 1954 | 4,308 | 131,760 | 68,900 | 300 |
| •South Pass Blk. 61, 1968 | 4,700 | 160,407 | 40,000 | 233 |
| •South Pass Blk. 62, 1965 | 3,900 | 108,579 | 79,379 | 133 |
| •South Pass Blk. 65, 1965 | 3,936 | 104,811 | 85,314 | 106 |
| •Ship Shoal Blk. 204, 1968 | 1,337 | 67,078 | 37,922 | 94 |
| •Ship Shoal Blk. 207, 1967 | 1,015 | 88,634 | 37,184 | 82 |
| •Ship Shoal Blk. 208, 1962 | 3,552 | 163,721 | 61,722 | 228 |
| •South Timbalier Blk. 21, 1939 | 2,028 | 218,267 | 45,105 | 237 |
| •South Timbalier Blk. 135, 1956 | 1,512 | 140,849 | 24,151 | 246 |
| •West Delta Blk. 30, 1949 | 5,700 | 451,780 | 41,675 | 469 |
| •West Delta Blk. 73, 1962 | 4,116 | 192,816 | 82,175 | 142 |
| Onshore South | | | | |
| Bay de Chene, 1941 | 444 | 96,826 | 17,508 | 24 |
| Bay St. Elaine, 1928 | 516 | 165,324 | 24,776 | 18 |
| Bayou Sale, 1941 | 566 | 162,137 | 2,649 | 20 |
| Black Bay West, 1953 | 1,953 | 146,959 | 8,272 | 66 |
| Caillou Island, 1930 | 1,812 | 604,727 | 71,524 | 143 |
| Cote Blanche Bay West, 1940 | 602 | 182,962 | 45,006 | 78 |
| Delta Farms, 1944 | 300 | 115,651 | 6,719 | 20 |
| Garden Island Bay, 1934 | 1,140 | 222,401 | 30,814 | 132 |
| Golden Meadow, 1938 | 672 | 136,111 | 3,618 | 185 |
| Grand Bay, 1938 | 408 | 170,922 | 3,352 | 37 |
| Hackberry, East, 1927 | 636 | 109,543 | 7,147 | 54 |
| Hackberry, West, 1928 | 1,132 | 143,371 | 5,016 | 109 |
| Iowa, 1931 | 144 | 99,447 | 553 | 31 |
| Jennings, 1901 | 174 | 116,649 | 460 | 168 |
| Lafitte, 1935 | 1,320 | 256,624 | 8,230 | 103 |
| Lake Barre, 1929 | 894 | 205,055 | 19,029 | 42 |
| Lake Pelto, 1929 | 474 | 117,588 | 16,827 | 26 |
| Lake Washington, 1931 | 2,640 | 245,030 | 13,736 | 85 |
| Leeville, 1931 | 564 | 142,210 | 6,657 | 37 |
| Paradis, 1939 | 648 | 127,298 | 7,952 | 32 |
| Quarantine Bay, 1937 | 1,006 | 173,428 | 15,000 | 34 |
| Timbalier Bay, 1938 onshore | 780 | 297,167 | 23,174 | 54 |
| Venice, 1937 | 876 | 182,754 | 6,714 | 55 |

| State Field Disc. date | 1989 prod. | Cum. prod. 1-1-90 | Est. rem. reserves | Est. no. wells |
|---|---|---|---|---|
| | | 1,000 bbl | | |
| Vinton, 1910 | 312 | 161,313 | 500 | 129 |
| Weeks Island, 1945 | 713 | 226,995 | 20,300 | 30 |
| West Bay, 1940 | 1,042 | 229,494 | 15,107 | 66 |
| North | | | | |
| Caddo-Pine Island 1905 | 2,681 | 364,187 | 10,000 | 10,423 |
| Delhi, 1944 | 552 | 212,259 | 34,099 | 59 |
| Haynesville, 1921 | 641 | 169,089 | 1,521 | 142 |
| Homer, 1919 | 408 | 98,783 | 1,500 | 196 |
| Rodessa, 1935 | 286 | 106,435 | 1,098 | 76 |
| ***MISSISSIPPI*** | | | | |
| Baxterville, 1944 | 2,216 | 241,380 | 8,175 | 232 |
| Heidelberg, 1944 | 2,431 | 177,240 | 9,740 | 306 |
| Tinsley, 1939 | 659 | 220,336 | 2,538 | 101 |
| ***MICHIGAN*** | | | | |
| Albion-Scipio, 1957 | 1,021(1984) | 132,130 + | 10,000 | 539 |
| ***MONTANA**** | | | | |
| Bell Creek, 1967 | 713 | 130,169 | 22,271 | 85 |
| Cut Bank, 1926 | 749 | 163,147 | 36,420 | 690 |
| Pine, 1951 | 1,279 | 106,401 | 4,408 | 96 |
| ***NEW MEXICO*** | | | | |
| Denton, 1949 | 860 | 139,553 | 2,140 | 176 |
| Empire-Abo, 1957 | 1,569 | 221,552 | 48,448 | 404 |
| Eunice-Monument, 1929 | 2,920 | 128,334 | 7,974 | 881 |
| Hobbs, 1928 | 6,947 | 304,429 | 20,000 | 588 |
| Maljamar, 1926 | 1,794 | 146,755 | 3,300 | 878 |
| Vacuum, 1929 | 10,538 | 442,780 | 40,000 | 1,249 |
| ***NORTH DAKOTA**** | | | | |
| Beaver Lodge, 1951 | 1,498 | 112,970 | 15,186 | 62 |
| Billings Nose, 1978 | 2,036 | 63,156 | 49,708 | 137 |
| Little Knife, 1977 | 2,512 | 53,593 | 55,412 | 126 |
| Mondak, 1976 | 266 | 13,348 | 82,621 | 59 |
| ***OKLAHOMA**** | | | | |
| Burbank, 1920 | 894 | 537,640 | 7,483 | 1,070 |
| Eola-Robberson, 1921 | 856 | 133,980 | 7,354 | 554 |
| Fitts, 1933 | 2,505 | 202,400 | 9,500 | 587 |
| Glen Pool, 1905 | 901 | 328,766 | 4,100 | 637 |
| Golden Trend, 1945 | 3,686 | 477,786 | 25,000 | 1,226 |
| Healdton, 1913 | 1,777 | 336,422 | 7,786 | 979 |
| Hewitt, 1919 | 1,982 | 270,353 | 12,000 | 765 |
| Oklahoma City, 1928 | 949 | 817,119 | 5,017 | 174 |
| Postle, 1960 | 1,126 | 107,519 | 13,795 | 222 |
| Sho-Vel-Tum, 1919 | 16,921 | 1,184,300 | 51,000 | 7,226 |
| Sooner Trend, 1965 | 3,862 | 299,406 | 16,138 | 3,569 |
| ***TEXAS*** | | | | |
| Railroad Commission<br>District 2-South | | | | |
| Greta, 1933 | 514 | 148,084 | 12,016 | 152 |
| Lake Pasture, 1953 | 1,740 | 89,524 | 10,904 | 259 |
| Tom O'Connor, 1934 | 6,432 | 754,280 | 48,568 | 701 |
| West Ranch, 1938 | 2,180 | 382,214 | 8,500 | 3181 |
| District 3-Gulf Coast | | | | |
| Anahuac, 1935 | 732 | 285,620 | 14,380 | 99 |
| Conroe, 1931 | 2,775 | 729,990 | 30,953 | 270 |
| Giddings,.1971 | 7,745 | 270,825 | 140,287 | 2,264 |
| Hastings, 1934 | 2,033 | 695,204 | 70,731 | 157 |
| Magnet Withers, 1936 | 1,453 | 112,413 | 3,547 | 195 |
| Oyster Bayou, 1941 | 745 | 160,949 | 17,351 | 42 |
| Thompson, 1931 | 3,531 | 476,071 | 23,829 | 190 |
| Tomball, 1933 | 294 | 121,350 | 9,574 | 99 |
| Webster, 1937 | 4,006 | 577,198 | 16,000 | 189 |
| District 4-South | | | | |
| Agua Dulce-Stratton, 1928 | 360 | 146,983 | 24,391 | 769 |
| Borregos, 1945 | 181 | 114,202 | 20,005 | 227 |
| Kelsey, 1938 | 216 | 115,075 | 36,031 | 65 |
| Plymouth, 1925 | 240 | 123,063 | 3,060 | 57 |
| Seeligson, 1925 | 207 | 271,690 | 55,337 | 252 |
| TCB, 1944 | 340 | 113,040 | 52,198 | 116 |
| White Point, E, 1938 | 93 | 104,127 | 6,247 | 92 |
| District 5-East | | | | |
| Alabama Ferry, 1983 | 2,552 | 17,152 | 83,848 | 274 |
| Van, 1928 | 2,751 | 524,711 | 12,249 | 348 |
| District 6-East | | | | |
| East Texas, 1930 | 35,257 | 5,044,004 | 953,501 | 9,318 |
| Fairway, 1960 | 2,081 | 194,772 | 15,696 | 98 |
| Hawkins, 1940 | 6,804 | 828,448 | 35,568 | 453 |
| Neches, 1953 | 971 | 104,951 | 5,065 | 167 |
| Quitman, 1948 | 1,260 | 122,606 | 7,180 | 180 |
| District 7C-West | | | | |
| Big Lake, 1923 | 476 | 130,416 | 3,024 | 74 |
| District 8-West | | | | |
| Andector, 1946 | 645 | 182,533 | 5,855 | 43 |
| Block 31, 1945 | 3,050 | 223,118 | 12,000 | 263 |
| Cowden, N., 1930 | 13,499 | 501,591 | 36,501 | 1,227 |
| Cowden, S, Foster, Johnson, 1932 | 8,723 | 18,419 | 31,277 | 1,577 |
| Dollarhide, 1945 | 2,531 | 196,311 | 8,917 | 206 |
| Dune, 1938 | 2,328 | 185,328 | 16,376 | 744 |
| Fullerton, 1942 | 7,200 | 355,400 | 14,800 | 870 |
| Goldsmith, 1934 | 6,456 | 761,972 | 27,296 | 1,556 |
| Howard Glasscock, 1925 | 4,608 | 409,116 | 21,392 | 2,023 |
| Iatan, E., 1926 | 2,796 | 145,752 | 9,204 | 1,299 |
| Jordan, 1937 | 876 | 129,852 | 1,644 | 229 |
| Keystone, 1930 | 1,572 | 314,652 | 7,802 | 730 |
| McElroy, 1926 | 6,648 | 472,197 | 50,152 | 1,934 |
| Means, 1934 | 5,808 | 234,406 | 14,192 | 709 |
| Midland Farms, 1944 | 3,576 | 245,556 | 15,040 | 304 |
| Sand Hills, 1931 | 2,316 | 250,523 | 19,284 | 1,593 |
| TXL, 1944 | 1,500 | 265,016 | 5,000 | 594 |
| Waddell, 1927 | 588 | 101,300 | 3,204 | 204 |
| Ward Estes, N., 1929 | 2,868 | 367,045 | 73,568 | 1,501 |
| Westbrook, 1920 | 2,004 | 90,004 | 14,000 | 642 |
| Yates, 1926 | 27,475 | 1,199,295 | 755,210 | 1,199 |
| District 8-A-West | | | | |
| Anton-Irish, 1944 | 3,120 | 179,030 | 21,070 | 239 |
| Cogdell Area, 1949 | 1,305 | 293,523 | 39,899 | 207 |
| Diamond M., 1948 | 1,332 | 240,750 | 14,731 | 492 |
| Kelly-Snyder, 1948 | 18,504 | 1,253,466 | 96,534 | 779 |
| Levelland, 1938 | 15,600 | 500,000 | 34,400 | 3,179 |
| Prentice, 1951 | 5,256 | 166,292 | 15,000 | 396 |
| Salt Creek, 1950 | 10,416 | 257,756 | 25,000 | 183 |
| Seminole, 1936 | 16,296 | 541,064 | 25,000 | 444 |
| Slaughter, 1936 | 17,853 | 1,047,653 | 32,000 | 2,969 |
| Spraberry Trend, 1951 | 18,744 | 672,132 | 39,000 | 7,263 |
| Wasson, 1936 | 26,201 | 1,738,099 | 60,000 | 2,045 |
| Welch, 1942 | 3,000 | 147,228 | 11,000 | 624 |
| District 10-Panhandle | | | | |
| Panhandle, 1921 | 6,012 | 1,429,298 | 14,000 | 12,289 |
| ***UTAH**** | | | | |
| Altamont, 1955 | 2,422 | 91,799 | 228,794 | 218 |
| Aneth, 1956 | 5,488 | 359,570 | 25,000 | 450 |
| East Anschutz Ranch, 1979 | 10,062 | 89,746 | 717,737 | 27 |
| Red Wash, 1951 | 1,050 | 78,612 | 12,327 | 155 |
| ***WYOMING**** | | | | |
| Brady, 1973 | 2,032 | 56,476 | 47,219 | 24 |
| Byron, 1918 | 998 | 121,627 | 6,658 | 58 |
| Elk Basin, 1915 | 2,975 | 434,841 | 22,775 | 182 |
| Frannie, 1928 | 932 | 116,871 | 4,068 | 63 |
| Garland, 1906 | 2,674 | 165,438 | 6,400 | 207 |
| Grass Creek, 1914 | 2,375 | 187,512 | 6,625 | 298 |
| Hamilton Dome, 1918 | 2,689 | 232,820 | 6,000 | 238 |
| Hartzog Draw, 1976 | 5,881 | 72,266 | 277,858 | 159 |
| Hilite, 1969 | 512 | 75,925 | 55,373 | 118 |
| Lance Creek, 1918 | 137 | 107,929 | 290 | 31 |
| Little Buffalo Basin, 1914 | 2,540 | 121,187 | 9,000 | 178 |
| Lost Soldier, 1916 | 1,296 | 210,724 | 5,800 | 96 |
| Oregon Basin, 1912 | 8,295 | 396,384 | 25,000 | 346 |
| Painter Reservoir, 1979 | 1,574 | 46,239 | 79,100 | 35 |
| Salt Creek, 1889 | 4,797 | 634,327 | 20,203 | 1,245 |
| Wertz, 1921 | 4,026 | 103,767 | 10,974 | 69 |
| Whitney Canyon,-Carter Creek, 1978 | 1,937 | 11,010 | 103,548 | 33 |

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*Petroleum Information data. •Offshore.

## Demand for OPEC oil

| | Estimate | | Projection | | |
|---|---|---|---|---|---|
| | 3rd Qtr. 1989 | 4th Qtr. 1989 | 1st Qtr. 1990 | 2nd Qtr. 1990 | 3rd Qtr. 1990 |
| | Million b/d | | | | |
| Demand (non-Communist) | 50.8 | 53.7 | 53.8 | 50.9 | 52.0 |
| Non-OPEC supply | 28.7 | 29.5 | 29.5 | 29.4 | 29.5 |
| OPEC supply | | | | | |
| Crude oil | 22.1 | 23.2 | 19.9 | 19.6 | 20.6 |
| NGL | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| Total OPEC | 24.0 | 25.1 | 21.8 | 21.5 | 22.5 |
| Total supply | 52.7 | 54.6 | 51.3 | 50.9 | 52.0 |
| Stock change | +1.9 | +0.9 | −2.5 | — | — |

Source: Non-Communist demand, non-OPEC supply, OPEC supply 3rd and 4th qtr. 1989 IEA; projections of stock change 1st, 2nd and 3rd qtr. 1990, and OPEC supply 1st, 2nd and 3rd qtr. 1990, OGJ

# Price questions cool international drilling

International drilling will increase in 1990 as activity catches up with last year's crude oil price gains.

But the increase will be modest because of lingering price uncertainty.

Oil & Gas Journal projects the average active rig count outside the U.S. and Canada at 940-950, compared with an estimated 923 in 1989. Last year's tally was down from 1,023 in 1988, a year of price weakness.

Some drilling increase seems inevitable after last year's price strength. Indeed, oil companies are raising exploration-production budgets for 1990, according to a Salomon Bros. Inc. survey.

More than 200 companies covered in the survey reported plans for a total upstream spending increase of 10.5%, with non-U.S. spending due the greatest growth.

The budgets are based on average oil price expectations of $18.37/bbl in 1990—21% more than the expected price reflected in Salomon Bros.' survey a year earlier.

But companies will be wary of prices significantly below expectation and may curtail spending at the first sign of problems.

OGJ assumes an average price for world export crudes of $16.50/bbl for 1990 vs. $16.64/bbl for all of last year, when drilling declined. It also assumes that in 1990 drilling plans will depend more on price stability than year-to-year comparisons of absolute prices.

And stability depends on the ability of the Organization of Petroleum Exporting Countries to adjust its production to seasonal demand swings.

### The call on OPEC crude

The first test will come soon. Demand seems likely to undershoot not only OPEC's recent production levels but also the significantly lower group quota set in November for the first half.

International Energy Agency (IEA) expects total consumption of petroleum products in traditionally free market countries to average 53.8 million b/d for the first quarter of 1990. Consumption will fall to 50.9 million b/d in the second quarter and 52 million b/d in the third. These levels represent gains of 1-1.2 million b/d from the same periods a year earlier.

IEA estimates that new supply (excluding stocks) from sources outside the Organization of Petroleum Exporting Countries will average 29.5 million b/d in the first and third quarters and 29.4 million b/d in the second quarter.

So stocks or OPEC liquids production will have to meet remaining demand: 24.3 million b/d in the first quarter, 21.5 million b/d in the second quarter, and 22.5 million b/d in the third quarter.

If the stock drawdown in the first quarter is 2.5 million b/d, a level similar to the last 2 years, demand for OPEC crude oil and NGL will be 21.8 million b/d. With OPEC NGL and condensate output averaging 1.9 million b/d, demand for OPEC crude oil falls to 19.9 million b/d for the first quarter of 1990 from 23.2 million b/d in the fourth quarter of 1989.

With no additional supply coming from stock drawdown, demand for OPEC crude will dip to 19.6 million b/d in the second quarter then climb to only 20.6 million b/d in the third quarter.

If there is a stock buildup comparable to last year's, demand for OPEC oil could be 1 million b/d higher in the second and third quarters. However, total stocks were up substantially at the end of 1989 so the midyear stock build is likely to be less.

These calculations illustrate the petroleum industry's uncertainty over price. Projections of quarterly demand for OPEC crude oil fall below the first-half 1990 OPEC quota of 22 million b/d. And OPEC is estimated to have ended 1989 producing at above quota.

IEA estimated fourth quarter 1989 OPEC crude oil production at 23.2 million b/d—3.3 million b/d more than expected demand for OPEC oil during the first quarter of 1990.

To prevent prices from dropping substantially following the winter heating season, OPEC will have to adjust production levels to accommodate this drop in demand. If OPEC members continue to produce above quota or even insist on producing at quota, the excess crude in the market will depress prices. Failure by OPEC to adjust production accordingly will make possible a price slump like those of 1986 and 1988.

### OPEC production

OPEC's average production jumped to 21.6 million b/d last year from 19.7 million b/d in 1988. Output averaged 19.9 million b/d in the first quarter last year, 21.1 million b/d in the second, 22.1 million b/d in the third, and 23.2 million b/d in the fourth.

Demand for OPEC oil surged on the strength of a decline in non-OPEC production, mostly from temporary factors such as platform accidents in the North Sea and the Exxon Valdez crude spill.

Much of this non-OPEC production has returned and will displace OPEC oil in 1990. Production in industrial countries fell to an average of 16 million b/d last year. It is expected to move back up to 16.2-16.3 million b/d in 1990.

In addition, IEA projects production in developing countries will increase 300,000-400,000 b/d. Total non-OPEC output, therefore, will climb by 500,000-700,000 b/d in 1990.

What that means is that not all the projected consumption gain will raise the call on OPEC oil. If there is no change in the stock level from yearend 1989 to yearend 1990, year-long demand for OPEC crude oil will average 21.6 million b/d—the same as in 1989 and close to the present quota.

If OPEC kept production close to the quota all year, it would be able to balance the oil market in 1990. But the seasonal fluctuations in demand will create problems. Demand for OPEC oil will weaken in the first and second quarters. If OPEC members insist on producing at current levels, the excess output will suppress prices—as early as the next couple of months.

### The 1989 price gains

OPEC started 1989 with production close enough to quota to enable prices to move up.

The average price of world export crude rose to $15.04/bbl in January from $13.07/bbl in December 1988. A drop in non-OPEC production in the second quarter pushed the average to $17.30/bbl.

The price weakened slightly in the third quarter to $16.17/bbl then jumped to $17.42/bbl in the fourth.

One element of second half price strength last year was the stock building that created a supply that might weaken the price in the first quarter of 1990.

If the buildup occurred to accommodate increased demand, it will not cause any major problems early this year.

But if there's any unanticipated weakness in demand, the stocks will be released, reducing demand for OPEC oil and pushing prices down.

### Last year's drilling

The 10% drilling decline last year outside the U.S. and Canada came despite a 21% increase in the average crude price.

But the drop occurred for reasons beyond the oil market. Most of the drilling decline occurred in Latin America, where the November active rig count by Baker Hughes was down 95 from a year earlier to 234.

And most of the Latin American drop occurred in two countries—Mexico, down 65 from a year earlier, and Brazil, down 19.

Both countries have severe economic problems necessitating deep cuts in the budgets of the state owned companies responsible for most of their drilling—all of it in Mexico's case.

Other financially troubled Latin American countries have been pushing exploration licensing as a way back to economic health.

Argentina, Ecuador, Peru, and Columbia, for example, have active licensing programs under way.

Most new licenses involve work commitments that will lift Latin American drilling as programs reach the drilling stage.

In other regions, late 1989 rig counts were close to their levels of 1988. The Asia-Pacific count was up 1 at 286, Africa down 8 at 90, the Middle East down 1 at 147, and Europe down 6 at 147.

As in Latin America, licensing activity has been brisk in many countries. That won't prevent a drilling sag if crude prices slump again, but it does mean companies can significantly increase activity if prices rise or at least stabilize at healthy levels. ▪

# Drilling Technology

# Horizontal drilling scores more successes

### About this report...

**Journal Drilling/Production Editor Guntis Moritis has again compiled exclusive and major data on horizontal drilling technology and projects for this report. The Journal's second annual survey of horizontal drilling is based on responses from operators around the world, who have also outlined their plans, and reflects up-to-date practices and objectives. Also included in this report is an article on an approach to borehole stability.**

**Guntis Moritis**
Drilling/Production Editor

The Journal's second exclusive compilation of horizontal drilling projects underscores that this technology is receiving worldwide acceptance, and the number of wells drilled continues to accelerate rapidly.

The following pages document many of the wells drilled in 1989 and the 1990 plans of operating companies.

As in OGJ's previous survey (OGJ, Feb. 27, 1989), this year's survey primarily includes wells drilled with horizontal laterals in the producing reservoirs that are longer than 1,000 ft. Both new wells and recompletions of existing wells are included.

The maximum angle of the horizontal laterals listed varies from 79.5° to 104°.

## More, deeper, longer

The 130 wells listed in this survey are only a part of all horizontal wells drilled. Wells with less than 1,000-ft horizontal laterals were in general excluded, and some small independents working in the Austin chalk trend in Texas did not respond to OGJ's survey.

The Texas Railroad Commission has, for example, identified 12 small operators (see box) in the Austin chalk who have tested horizontal wells; another 19, not listed, have permits to drill. However, because the primary intent of the survey is not sim-

*TO DRILL the build section at a 14°/100 ft rate, a 10-ft motor is being run in a Union Pacific Resources well in the Giddings field.*

Fig. 1

First short-radius well over 1,000-ft horizontal length

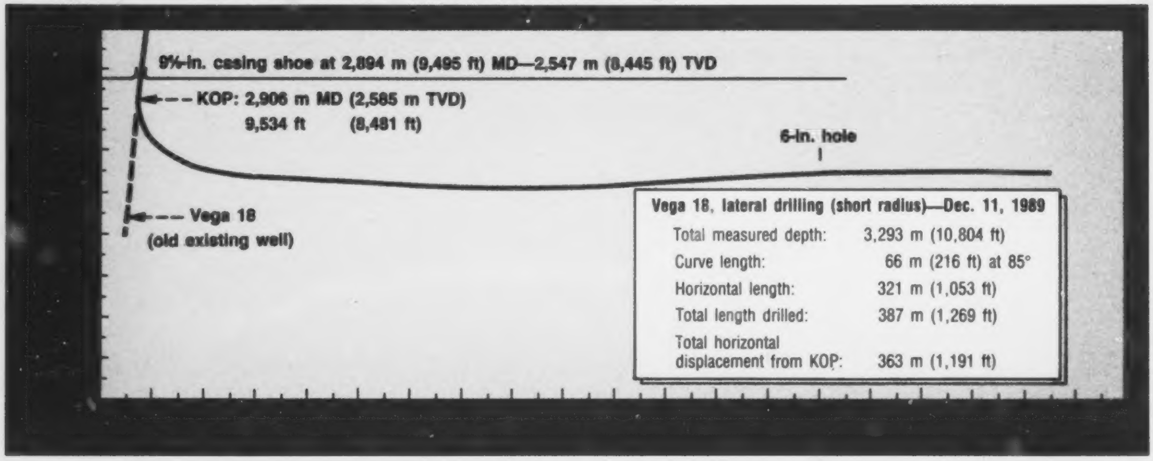

9⅝-in. casing shoe at 2,894 m (9,495 ft) MD—2,547 m (8,445 ft) TVD
KOP: 2,906 m MD (2,585 m TVD)
9,534 ft (8,481 ft)
6-in. hole
Vega 18
(old existing well)
Vega 18, lateral drilling (short radius)—Dec. 11, 1989
Total measured depth: 3,293 m (10,804 ft)
Curve length: 66 m (216 ft) at 85°
Horizontal length: 321 m (1,053 ft)
Total length drilled: 387 m (1,269 ft)
Total horizontal displacement from KOP: 363 m (1,191 ft)

Table 1

*Results for five of Oryx's wells*

| Well | Prehorizontal rate, bo/d | Prehorizontal cumulative production, 1,000 bbl of oil | Date of horizontal completion | Horizontal length, ft | Post-horizontal rate, bo/d | Current rate, bo/d | Cumulative from horizontal, 1,000 bbl of oil | Cost of completion,* $1,000 |
|---|---|---|---|---|---|---|---|---|
| Baggett No. 7 | 5 | 126 | Dec. 1985 | 240 | 107 | 45 | 37 | |
| Baggett No. 11 | 7 | 66 | Dec. 1986 | 140 | 36 | 38 | 16 | |
| Baggett No. 9 | 15 | 175 | Sept. 1987 | 950 | 338 | 215 | 54 | 685 |
| Baggett No. 13 | New well | — | Apr. 1988 | 2,250 | 1,607 | 891 | 112 | 2,700 |
| Jones "B" No. 3 | New well | — | Apr. 1989 | 2,327 | 1,249 | 430 | 20 | 1,600 |
| Avant No. 1 | New well | — | May 1989 | 2,650 | 615 | 615 | 6 | 880 |
| Panther Hollow No. 11 | 12 | 70 | July 1989 | 1,715 | 507 | 507 | 5 | 700 |

* Typical vertical well cost is approximately $450,000

ply to count wells drilled, but to reveal drilling practices, the lack of response is not too important in this case because the respondents do describe the typical practices in the chalk.

The drilling activity in the Pearsall (Austin chalk) field in South Texas has been described as "hysterical." Leasing costs have jumped from $20-50/acre to $200-500/acre.

From virtually no rigs operating in the area, over 40 rigs, including large workover rigs, are at this writing drilling horizontal laterals in both new and old holes. One estimate is that 80 rigs may soon be working in this area.

### Records

A number of new drilling records were set in 1989. Unocal drilled the longest horizontal lateral to date. Offshore California, its Point Pedernales well A-16 has a horizontal section extending for 5,743 ft in the reservoir. Maximum angle is 87.5°. This surpassed the previous record of 4,013 ft by Esso Resources Canada Ltd. in its Norman Wells K-50X well, drilled in 1987.

The 12,740-ft horizontal displacement of the Unocal well is the longest to date for a horizontal well. Also, as an extended-reach well the displacement is the longest drilled offshore California. Because the true vertical depth is a shallow 4,420 ft, about 10,000 ft of well bore was drilled at angles above 80°.

The Unocal well is completed with a cement liner. This completion allows producing the furthest 1,000-ft portion of the hole first. And as water encroaches, that portion will be sealed and a new zone opened for production.

Unocal's Point Pedernales well is classed as a long-radius well. For a medium-radius buildup, the well with the record for the longest horizontal displacement is Oryx Energy Co.'s Stroman-Harris No. 2. Drilled in the Pearsall field, the horizontal displacement length is 4,164 ft, 4,110 ft horizontally within the reservoir.

With short-radius techniques, SELM (Montedison group) has drilled horizontal laterals over 1,000 ft. Its Vega 18 well, offshore Sicily, has a 6-in. horizontal lateral with a length of 1,053 ft. The length of the build curve was 216 ft, and the maximum build rate was 51.5°/30 m (Fig. 1). Directional control was done with 4 ½-in. measurement-while-drilling (MWD) tools. The horizontal section was logged with dual laterolog resistivity and microspherically focused tools conveyed on drill pipe.

Subsequently, Vega 5 (not listed in Table 4) drilled a 1,221-ft horizontal lateral. This is currently the world record length for a short-radius well.

The horizontal well that has the highest production rate is Norsk Hydro's 16T located in block 31-2 offshore Norway. The well was drilled to test the feasibility of producing a relatively thin (22 m) oil column under a large gas accumulation in the Troll field. The well is flowing 30,000 bo/d to the production test ship "Petrojarl." This production rate is roughly 10 times more than would be expected from a vertical well.

Norsk Hydro plans to produce the well for 1 year before deciding whether to develop the oil column with additional horizontal drilling. Harald Norvik, president of Norway's Statoil, largest oil producer in the North Sea, predicted during a recent trip to the U.S. that horizontal drilling will completely change the economics of North Sea oil development.

In another well in the North Sea, one of Shell Internationale Petroleum Maatschappij's operating companies, Nederlandse Aardolie Mij. B.V.

Table 2

## Horizontal wells for 1990 with over 1,000-ft horiz. lateral in reservoir

| Company | Number of wells | Location |
|---|---|---|
| Amoco Canada | 4-8 | ? |
| Aostra | 6 | Athabasca oil sands |
| ARCO Indonesia | 2 | Bima field, Java Sea |
| ARCO | 4-6 | Lisburne and Prudhoe Bay fields, Alas. |
| Apache Corp. | 4-6 | North Dakota |
| BP Exploration (Alaska) | 2 | Prudhoe Bay, Alas. |
| Broken Hill Proprietary Co., Ltd. | ? | Timor Sea Development |
| Canada Northwest Energy | 2 | Central/Northeast Alta. |
| Chevron | 4 | Kurtin field, and Williston basin |
| Chevron | 3 | Zaire, Cabinda, and Angola |
| Conoco | | Proprietary |
| CS Resources Ltd. | 20 | Canada |
| Elf Aquitaine | 10 | Italy, Oman, Gabon, Angola |
| Enserch Exploration Inc. | 1 | ? |
| Exxon | 1 | Billings Co., N.D. |
| Home Oil Co. | 2 | Sask.-Winnipegois formation |
| Hunt Oil Co. | ? | To be determined |
| Kerr-McGee Canada Ltd. | 1 | Alta. |
| Ladd Petroleum Co. | 1 | Canada |
| Maersk Olie OG Gas AS | 8 | Offshore Denmark-Dan, Tyra, & Valdemar fields |
| Marathon Oil Co. | 1 | Mich. |
| Maxus Energy Corp. | 4 | N.D. |
| Meridian Oil | 40-45 | N.D. and Tex. |
| Mobil Oil Canada | 5 | Rainbow Lake, Lloydminster, Cold Lake |
| Oryx Energy | 64 | Pearsall |
| Oryx Energy | 20 | ? |
| Pacific Enterprises Oil Co. | 12 | Williston basin, N.D. |
| Phillips Petroleum Co. | 1 | U.K. North Sea |
| Saskoil | 10 | Sask. and Alta. |
| San Antonio Oil & Gas | 6-10 | Austin chalk, Tex. |
| Sceptre Resource Ltd. | 10 | Alberta & Saskatchewan |
| SELM (Montedison) | 2 | Vega |
| Shell Internationale | 4 | Sette Cama Concession - Gabon |
| Shell Internationale | 3 | 1 land, 2 offshore, The Netherlands |
| Shell Internationale | 5 | FRB West field, Baronia, Malaysia |
| Shell Internationale | 8 + | Oman, various fields |
| Shell Internationale | 2 | Barque, Dunlin fields, U.K. North Sea |
| Tesoro | ? | South Tex. and Indonesia |
| Texaco | 1 | Block 13/22 North Sea |
| Texaco | 5 | Pearsall field, Frio Co., Tex. |
| Texaco | 5 + | Billings & McKenzie counties, N.D., Permian basin |
| Trendwell Oil | 1 | Mich. |
| Union Pacific Resources | 50 | Giddings & Pearsall, Tex., Dunn Co., N.D. |
| Unocal | 3 | Offshore Calif. |
| Unocal Netherlands | 5 | Helder & Hoorn fields, The Netherlands offshore |
| Western Mining Corp. Ltd. | 2 | North Herald & South Pepper fields |
| Winn Exploration Co. | 30 | Pearsall field |
| Wintershall Energy | 1 | Monroe Gas field, Monroe, La. |
| Yacimientos Petroliferos Bolivianos | 1 | Area Camiri (Fana Subandina) |
| **Total** | **376-393** | |

Table 3

## Horizontal wells planned for 1990 (short-radius wells with horizontal lengths less than 1,000 ft)

| Company | No. of wells | Location |
|---|---|---|
| Amoco Canada | 1 | ? |
| Bow Valley Industries Inc. | 1 | Undetermined |
| Chevron Canada | 1 | Alta. |
| Home Oil Co. | 1-3 | Cecil-Royce Area of Alta. |
| Husky Oil | 3 | Rainbow Lake, Alta. |
| Marathon Oil Co. | 6 | Mich. |
| Petromer Trend | 2 | Salawati basin, Irian Jaya, Indonesia |
| San Antonio Oil & Gas | 1 | Re-entry Austin chalk near Giddings, Tex. |
| Saskoil | 2 | Sask. |
| SELM (Montedison) | 2 | Vega |
| Shell Internationale | 2 | Southeast Turkey |
| Texaco | 1 + | Kern River field and possibly in Permian basin |
| Trendwell Oil | 1 | Mich. |
| Unocal | 2 | Taft, Coalinga, Calif. |
| **Total** | **26-28** | |

**Mud type:**
BM – Bentonite mud
FW – Fresh water
Gel – Bentonite mud
IBM – Improved bentonite mud
IM – Invent emulsion
KCl – Potassium chloride mud
LG – Lignosulfonate
LS ND – Low solids nondispersed
LTox – Low Tox
Nat – Native
OBM – Oil-base mud
PM – Polymer
SB – Saturated brine
UD – Ultridrill
SW – Salt water

**Completion type:**
CL – Cemented liner
IT – Insulated tubing
GPS – Gravel-packed screens
OH – Open hole
PC – Perforated casing
Perf – Perforations
PGPL – Prepacked gravel-packed liner
Pkr – Packer
PL – Perforated liner
SL – Slotted liner
UC – Uncemented casing
WRS – Wire wrapped screen

**Artificial lift:**
ESP – Electric submersible pump
GL – Gas lift
GLA – Gas lift available
LSRP – Long stroke rod pumps
MP – Moineau-type pump
Rec – Reciprocal pump
RP – Rod pump
PCP – Progressive cavity pump

**Present status of well:**
F – Flowing
P – Producing
S – Suspended
SI – Shut-in
C – Completing
GP – Gas producer
TH – Tight hole
PL – Plugged
PL/A – Plugged and abandoned
GI – Gas injector
E – Evaluating
D – Drilling
PMP – Pumping
T – Testing
T/A – Temporarily abandoned

**Reservoir rock:**
C – Carbonate
Ca – Calcite
Cal K – Calcareous karst
Ch – Chalk
KL – Karstified limestone
FS – Fractured sandstone
LS – Limestone
S – Sand
Si – Siltstone
Sh – Shale
SS – Sandstone
US – Unconsolidated sand

**Main reservoir heterogeneity:**
CB – Chert bands
Disc Sh – Discontinuous shale
DP – Dual porosity
DS – Dolomite stringers
F – Fractures
Hom – Homogeneous
TL – Tight layers
TM – Tight matrix
TS – Tight streaks

**Reason for horizontal drilling:**
CRG – Increase critical rate to gas
CRW – Increase critical rate to water
CS – Coning of solvent in miscible flood
E – Evaluated horizontal drilling
IFS – Intersect fracture system
IR – Improve recovery
GC – Gas coning
MPG – Minimize gas production
PI – Productivity increase
PW – Peripheral well
TOC – Thin oil column
Topo – Topological
WC – Water coning

(NAM), has drilled the deepest horizontal lateral. The FD-103 well on Block L-13, offshore The Netherlands, has a true vertical depth of 11,484 ft. The 83° horizontal lateral extended for 2,858 ft.

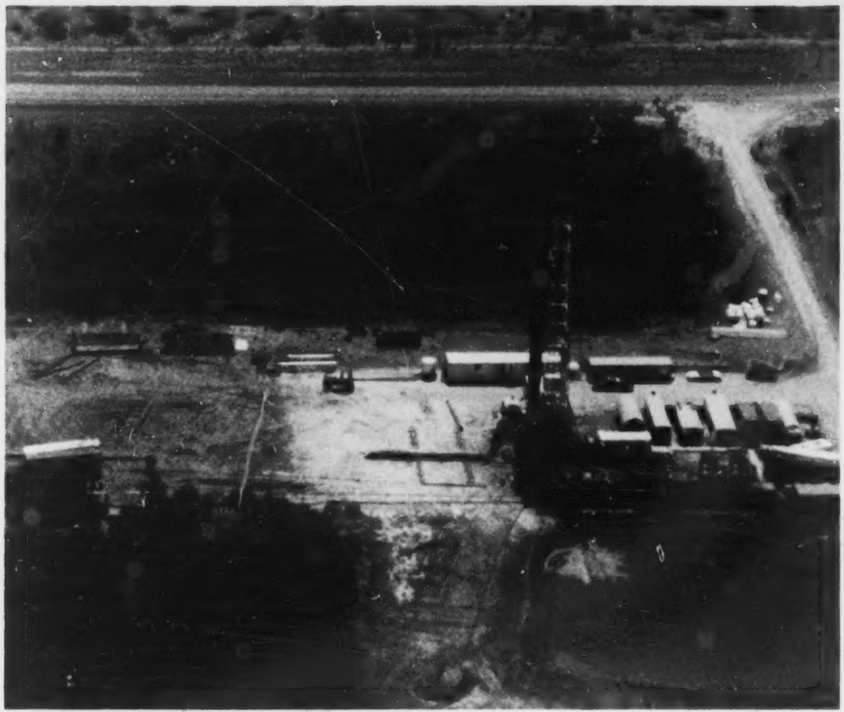
Last year's survey had Meridian Oil's 33-19H well in the Bicentennial field of North Dakota as the deepest at 10,796 ft.

### Pearsall field

One of big successes in horizontal drilling has been the Pearsall field (Fig. 2) in South Texas. Oryx Energy Co. started the boom. In OGJ's tabulation (Table 4), information on 21 of Oryx's wells is summarized in one entry.

As of January, 12 of Oryx's wells had been completed, 4 were being tested, and 5 were being drilled. Oryx's plans for this area include drilling an additional 64 wells during 1990.

During the week ending Jan. 4, Oryx's production from 15 of its horizontal wells averaged 7,200 bo/d and 4.3 MMcfd of gas. By year-end, 7



*HORIZONTAL DRILLING in the Pearsall field, South Texas (Fig. 2).*

### Texas RRC well potentials—horizontal completions by small independents

| Field | Operator | Lease, Well No. | County | Oil, bo/d | Water, bw/d |
|---|---|---|---|---|---|
| Giddings (Austin chalk) | Clayton Williams Jr. | R. W. Noack Unit, 1 | Lee | 221 | 0 |
| | | A. M. Krause, 1 | Lee | 70 | 53 |
| | FGB Energy Inc. | C. A. Triolo, 1 | Fayette | 426 | 0 |
| | J & G Operating | Allison, Al | Fayette | PA | — |
| | | John Unit, 1 | Lee | 60 | 0 |
| | | Weiser, 2 | Lee | 14 | 34 |
| | | Winkler "B", 1 | Lee | 76 | 6 |
| | Majestic Petroleum Corp. | Majestic-Heinkel, 1 | Lee | 951 | 241 |
| | | Majestic-Willie, 1 | Lee | 84 | 4 |
| | | Majestic-Monroe, 1 | Lee | 158 | 10 |
| | | Majestic-Trousdale, 1 | Fayette | 567 | 8 |
| | | Majestic-Trousdale "A", 2 | Fayette | 756 | 338 |
| | | Majestic-Hartmann, 1 | Fayette | 225 | 230 |
| | Ted R. Ferguson | Weishuhn, 1 | Fayette | 674 | 130 |
| | | Emma, 1 | Fayette | 100 | 71 |
| | | Oscar Unit, 1 | Lee | 40 | 35 |
| | | Lovings, 1 | Lee | 51 | 0 |
| | | Luther Unit, 1 | Lee | 232 | 141 |
| | | Gus Hoffman, 1 | Lee | 1,380 | 175 |
| | | Emil Miertschin, 1 | Lee | 390 | 3 |
| | | Melton Unit | Lee | 399 | 0 |
| | | Proske, 1 | Lee | 11 | 30 |
| | | R. R. Richter, 1 | Lee | 41 | 61 |
| | | Armadillo, 1 | Lee | 52 | 3 |
| | | Matthew II, 1 | Lee | 224 | 0 |
| | United Oil & Minerals | Daniel, 1 | Lee | 567 | 148 |
| | WCS Oil & Gas | Weishuhn, 1 | Fayette | 98 | 66 |
| | | Shorty Unit, 1 | Fayette | 680 | 430 |
| | | Rauch Unit, 1 | Fayette | 48 | 21 |
| | | Bald Eagle, 2 | Fayette | 35 | 31 |
| | | D. B. Johnson, 1 | Lee | 40 | 66 |
| | | Bamsch, 1 | Lee | 48 | 136 |
| | | Bonner Jackson, 4 | Lee | 670 | 120 |
| Giddings (Buda) | Majestic Petroleum | Owen Unit, 1 | Lee | 671 | 0 |
| Kurten (Buda) | Graham Royalty, Ltd. | J.W. See et al Unit, 1 | Burleson | 27 | 29 |
| Pearsall (Austin chalk) | Clayton Williams | Burns Heirs, 2 | Frio | T.A. | |
| | Majestic Petroleum Corp. | Majestic-Lang, 1 | Zavala | 710 | 178 |
| | Pinnacle Royalty & Operating Co. | G. W. Hatch, 1 | Dimmitt | 1,412 | 219 |
| | Snow Operating | Julia Harris, 4 | Frio | 355 | 125 |
| | Weber Energy Corp. | Wright, 2 | Frio | 965 | 0 |
| | | Harvey Wright, 1 | Frio | 1,135 | 25 |
| | | Freeborn "A", 1 | Frio | 440 | 14 |
| Pruitt, S. (Escondido) | MG Exploration | Nixon-Dillard, 2 | Frio | 15 | 10 |

# Horizontal well survey

| Company | Field, location | Well number | Present status of the well* | Completion date | Total days, drill and complete | True vertical depth, ft | Horizontal displacement, ft | Maximum inclination, degrees | Length drilled horizontally in reservoir, ft | Length of pay, ft | Top drive | Maximum buildup rate, degrees | Mud type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alcorn Int. | Galoc, N.W. Palawan, Phillipines | 1A | T/A | 4/89 | 28 | 7,337 | 2,600 | 91.6 | 2,000 | 1,300 | no | 11.4/100 ft | IM |
| Amoco | Wabasca, Alta. | 4-24 | P | 11/88 | 9 | 1,398 | 1,673 | 90.9 | 1,762 | 1,762 | no | 6/30 m | PM |
| Amoco | Wabasca, Alta. | 12A-13 | P | 10/88 | 10 | 1,398 | 1,641 | 90.3 | 1,732 | 1,732 | no | 6.1/30 m | PM |
| Amoco | Primrose, Alta. | 13-5 | P | 8/89 | 9 | 1,608 | 1,644 | 93.8 | 1,864 | 1,864 | no | 6/30 m | PM |
| Aostra | Athabasca, Alta. | 6 wells | C | 12/87 | 16-58 | — | 525 | 90 | 295 | 197 | yes | 6/30 m | — |
| ARCO | Lisburne, Alas. | L4-10 | F | 12/89 | 35 | 9,100 | 3,145 | 83 | 1,362 | — | no | 3.4/100 ft | OBM |
| ARCO | Bima, Java Sea | ZUB-8 | P | 1/89 | 15 | 2,678 | 3.124 | 94 | 2,150 | 1,971 | no | 8.4/100 ft | SW, LG |
| ARCO | Prudhoe Bay, Alas. | DS18-75 | P | 6/89 | 34 | 8,750 | 7,895 | 87 | 1,012 | 950 | no | 2.5/100 ft | OBM |
| ARCO | Prudhoe Bay, Alas. | DS18-21 | P | 5/89 | 31 | 8,780 | 7,088 | 93.5 | 939 | 900 | no. | 2.5/100 ft | OBM |
| ARCO | Prudhoe Bay, Alas. | DS5-27 | P | 11,89 | 35 | 9,011 | 6,510 | 95 | 1,255 | 1,000 | no | 2.0/100 ft | OBM |
| ARCO | Prudhoe Bay, Alas. | DS5-21 | P | 10/89 | 43 | 9,027 | 2,720 | 90.7 | 1,100 | 1,000 | no | 4.0/100 ft | OBM |
| Bechtel | Elk Hills, Calif. | 316-36R | C | 1/90 | 75 | 7,292 | 1,352 | 91.2 | 1,206 | 962 | no | 14/100 ft | OBM |
| BP | Cyrus, U.K. North Sea | 16/28-13 | S | 11/89 | 85 | 8,432 | 2,297 | 92.6 | 2,625 | — | yes | 3.5/100 ft | OBM |
| BP | Prudhoe Bay, Alas. | W-21 | P | 4/89 | 31 | 9,103 | 4,733 | 81.55 | 894 | 529 | yes | 3.0/100 ft | WBM |
| Chevron | Little Knife, N.D. | Zabolotny 5-3 | C | — | 86 | 10,903 | 2,284 | 94 | 1,920 | — | no | 20.8/100 ft | OMB |
| Conoco | Elkhorn Ranch, N.D. | Fed. 10-1 | F | 10/89 | 40 | 10,534 | 2,577 | 90.5 | 1,947 | 1,947 | no | 17/100 ft | IM |
| CS Res. | Winter, Sask. | B7-29 | P | 9/89 | 14 | 2,175 | 3,445 | 94.5 | 2,494 | — | no | 3/10 m | PM |
| CS Res. | Winter, Sask. | A7-32 | P | 10/89 | 9 | 2,238 | 3,448 | 92.8 | 2,362 | — | no | 3/10 m | PM |
| CS Res. | Winter, Sask. | A2-32 | P | 10/89 | 10 | 2,228 | 3,429 | 92.75 | 2,494 | — | no | 3/10 m | PM |
| Elf | Chacon, Jicarilla, N.M. | CAD-11 | SI | 1/88 | — | 7,317 | 2,845 | 91.9 | 2,143 | — | no | 14/100 ft | PM |
| Elf | Rospo Mare, Off. Italy | RSM 221 | F | 12/89 | — | — | — | — | — | — | yes | — | SW |
| Elf | Rospo Mare, Off. Italy | RSM 222 | F | 11/89 | 38 | 4,436 | 6,588 | 92.1 | 3,389 | 3,389 | yes | 1.8/10 m | SW |
| Elf | Rospo Mare, Off. Italy | RSM 118 | F | 4/89 | 29 | 4,419 | 3,635 | 90.2 | 2,018 | 2,018 | yes | 2.0/10 m | SW |
| Elf | Rospo Mare, Off. Italy | RSM 119 | F | 6/89 | 42 | 4,465 | 4,354 | 91 | 2,375 | 2,375 | yes | 2.0/10 m | SW |
| Elf | Rospo Mare, Off. Italy | RSM 120 | F | 8/89 | 42 | 4,354 | 6,637 | 92.2 | 2,251 | 2,251 | yes | 2.6/10 m | SW |
| Elf | Rospo Mare, Off. Italy | RSM 105 | F | 12/88 | 52 | 4,167 | 4,249 | 90.4 | 1,618 | 1,181 | yes | 2.3/10 m | SW |
| Elf | Rospo Mare, Off. Italy | RSM 116 | F | 1/89 | 38 | 4,511 | 3,497 | 92.6 | 1,995 | 1,995 | yes | 2.3/10 m | SW |
| Elf | Rospo Mare, Off. Italy | RSM 117 | F | 3/89 | 55 | 4,429 | 6,470 | 91 | 4,432 | 4,432 | yes | 1.4/10 m | SW |
| Husky Oil | Rainbow Key, River "G", Alta. | 16-29-108-08W6M | F | — | 66 | 6,375 | 1,237 | 92.8 | 1,145 | 1,145 | no | 19.8/100 ft | PM |
| Ladd | Upper Chester, Okla. Dombey | Leon No. 2-27 | F | 12/88 | 90 | 6,580 | 1,530 | 90 | 1,000 | 750 | no | 16/100 ft | OBM |
| Maersk | Dan, Off. Denmark | MFA-13 | F | 5/89 | 64 | 6,190 | 5,083 | 90 | 3,328 | 3,328 | yes | 6.7/100 ft | UD |
| Maersk | Dan, Off. Denmark | MFA-17 | F | 10/89 | 91 | 6,272 | 9,524 | 89.7 | 3,333 | 3,333 | yes | 11.6/100 ft | UD |
| Maersk | Dan, Off. Denmark | MFA-16 | F | 8/89 | 84 | 6,290 | 9,300 | 92.5 | 4,507 | 4,507 | yes | 5.4/100 ft | UD |
| Maersk | Tyra, Off. Denmark | TEB-1 | F | 3/89 | 91 | 6,755 | 10,454 | 92.1 | 3,406 | 2,600 | yes | 29.4/100 ft | OBM |
| Meridian | Basin Fruitland Coal, N.M. | Sunray H #201 | F | 3/89 | 86 | 3,230 | 1,354 | 94 | 1,088 | 1,088 | yes | 13.4/100 ft | LS, ND |
| Meridian | Basin Fruitland Coal, N.M. | San Juan 32/5 U #100 | F | 12/88 | 56 | 2,995 | 1,600 | 97 | 1,135 | 1,135 | yes | 14.4/100 ft | LS, ND |
| Meridian | Flying "W" (Wolfcamp), Tex. | 19-2 | P | 4/89 | 62 | 8,435 | 1,900 | 94 | 1,436 | 1,320 | no | 18/100 ft | PM |
| Meridian | Acetate (Fusselman), Tex. | 1 | P | 5/88 | 79 | 9,929 | 1,955 | 89 | 1,110 | 175 | no | 23/100 ft | PM |
| Meridian | Bicentennial, N.D. | 31-29H | F | 10/89 | 41 | 10,714 | 1,883 | 90 | 1,883 | 1,883 | no | 13/100 ft | IM |
| Meridian | Bicentennial, N.D. | 33-29H | F | 10/89 | 40 | 10,772 | 2,193 | 90 | 2,193 | 2,193 | no | 13/100 ft | IM |
| Meridian | Flattop Butte, N.D. | 23-33H | F | 5/89 | 45 | 10,614 | 2,275 | 90 | 2,275 | 2,275 | no | 13/100 ft | IM |
| Meridian | Pierre Creek, N.D. | 13-1H | F | 11/89 | 41 | 10,623 | 10,623 | 90 | 10,623 | 1,535 | no | 13/100 ft | IM |
| Meridian | Bicentennial, N.D. | 33-35H | F | 8/89 | 33 | 10,711 | 2,465 | 90 | 2,465 | 2,465 | no | 13/100 ft | IM |
| Meridian | Elkhorn Ranch, N.D. | 44-25H | F | 9/89 | 36 | 10,404 | 2,357 | 90 | 2,357 | 2,357 | no | 13/100 ft | IM |
| Meridian | Roughrider, N.D. | 21-33H | F | 2/89 | 51 | 10,473 | 1,845 | 90 | 1,845 | 1,845 | no | 13/100 ft | IM |
| Meridian | Roosevelt, N.D. | 14-35H | F | 6/89 | 50 | 10,410 | 3,516 | 90 | 3,516 | 3,516 | no | 13/100 ft | IM |
| Meridian | Roosevelt, N.D. | 14-33H | F | 4/89 | 35 | 10,362 | 2,397 | 90 | 2,397 | 2,397 | no | 13/100 ft | IM |
| Meridian | Bicentennial, N.D. | 31-17H | F | 3/89 | 59 | 10,762 | 2,101 | 90 | 2,101 | 2,101 | no | 13/100 ft | IM |
| Meridian | Elkhorn Ranch, N.D. | 13-3H | F | 12/89 | 34 | 10,522 | 2,275 | 90 | 2,275 | 2,275 | no | 13,100 ft | IM |
| Meridian | Stillwater, N.D. | 41-31H | F | 11/89 | 58 | 10,396 | 2,954 | 90 | 2,954 | 2,954 | no | 13/100 ft | IM |
| Meridian | Elkhorn, N.D. | 24-1H | F | 8/89 | 43 | 10,507 | 1,416 | 90 | 1,416 | 1,416 | no | 13/100 ft | IM |
| Meridian | North Morgan Draw, N.D. | 41-17H | F | 12/89 | 41 | 10,334 | 2,090 | 90 | 2,090 | 2,090 | no | 13/100 ft | IM |
| Meridian | Roosevelt, N.D. | 12-35H | — | 11/89 | 32 | 10,237 | 2,227 | 90 | 2,227 | 2,227 | no | 13/100 ft | IM |
| Meridian | Squaw Cap, N.D. | 34-21H | — | — | — | 10,577 | 2,375 | 90 | 2,375 | 2,375 | no | 13/100 ft | IM |
| Meridian | Poker Jim, N.D. | 43-11H | F | 2/89 | 62 | 10,691 | 1,559 | 90 | 1,559 | 1,559 | no | 13/100 ft | IM |
| Meridian | Elkhorn Ranch, N.D. | 44-35H | F | 11/89 | 30 | 10,377 | 2,225 | 90 | 2,225 | 2,225 | no | 13/100 ft | IM |
| Meridian | Pierre Creek, N.D. | 44-7H | F | 7/89 | — | 10,840 | 3,200 | 90 | 3,200 | 3,200 | no | 13/100 ft | IM |
| Meridian | Spring Lake, N.D. | 22-27H | — | 6/89 | 46 | 9,730 | 2,660 | 90 | 2,660 | 2,660 | no | 13/100 ft | IM |
| Meridian | Bicentennial, N.D. | 42-31H | F | 10/89 | 31 | 10,811 | 2,250 | 90 | 2,250 | 2,250 | no | 13/100 ft | IM |
| Meridian | Roughrider, N.D. | 14-27H | F | 9/89 | 45 | 10,646 | 2,335 | 90 | 2,335 | 2,335 | no | 13/100 ft | IM |
| Meridian | Elkhorn Ranch, N.D. | 43-3H | F | 6/89 | 44 | 10,545 | 2,556 | 90 | 2,556 | 2,556 | no | 13/100 ft | IM |
| Meridian | Firehole, N.D. | 43-7 | F | 8/89 | 60 | 10,794 | 3,200 | 90 | 3,200 | 3,200 | no | 13,100 ft | IM |
| Meridian | Elkhorn Ranch, N.D. | 12-33H | F | 4/89 | 53 | 10,545 | 2,945 | 90 | 2,945 | 2,945 | no | 13/100 ft | IM |
| Meridian | Bicentennial, N.D. | 41-19H | F | 7/89 | 40 | 10,595 | 1,470 | 90 | 1,470 | 1,470 | no | 13/100 ft | IM |
| Meridian | Rawhide, Mont. | 22-32H | F | — | — | 10,122 | 2,250 | 90 | 2,250 | 2,250 | no | 13/100 ft | IM |
| Mobil | Wolf Lake, Alta. | 1-17-<br>64 6W4M | F | 5/89 | 20 | 1,266 | 2,169 | 92 | 1,293 | 1,007 | no | 6.9/30 m | PM |
| Norsk Hydro | Troll, Off. Norway | 31-2-16T | T | 12/89 | 87 | 5,148 | 3,281 | 90 | 1,647 | 1,647 | yes | 3/30 m | SB |
| Oryx | Pearsall, Tex. | 21 wells | P | 1985-89 | 30 | 7,000 | 140-4,164 | 90 | 140-4,110 | — | — | — | — |
| Pacific Ent. | Bicentennial, N.D. | 41-19H | SI | 11/89 | 101 | 10,779 | 2,992 | 94.7 | 2,565 | 2,142 | no | 13.5/100 ft. | OBM |
| San Antonio Oil & Gas | Thirteen, Tex. | SAGO-Exxon' Bowers 1 | D | 12/89 | 40 | 5,840 | 2,030 | 91 | 2,030 | 600 | no | 19.5/100 ft | KC1 |

Table 4

| Artificial lift | Completion | Spacing, acres | Pay thickness, ft | Permeability, | Viscosity, cp | Temperature, °F. | Reservoir rock | Main reservoir heterogeneity | Reason for horizontal drilling | Oil production, b/d | Water production, bw/d | Gas production, Mcfd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| — | PL | — | 150 | 60-80 md | 5.2 cst | 100 | SS | — | PI | 4,000 | 600 | 900 |
| PCP | SL | 40 | 10 | — | — | — | US | — | E | — | — | — |
| PCP | SL | 40 | 10 | -- | — | — | US | — | E | — | — | — |
| PCP | SL | 6 | 59 | — | — | — | US | — | E | — | — | — |
| — | WRS | — | 66 | 1-10 D | 1,000,000+ | 50 | US | TL | — | — | — | — |
| — | SL | 320 | 259 | — | — | 175 | LS | — | IFS | 1,000 | — | — |
| ESP | SL | 60 | — | +4 D | 32 | 155 | C | VUGS | GS/WC | 150 | 50 | 65 |
| — | SL | 80 | 35 | — | — | — | SS | — | MGP | 1,400 | 0 | 1,120 |
| — | SL | — | 25 | — | — | — | SS | — | MGP | 1,200 | 0 | 960 |
| GL | SL | 80 | 35 | — | — | — | SS | — | MGP | 1,200 | 0 | 960 |
| — | SL | 80 | 35 | — | — | — | SS | — | MGP | 1,000 | 0 | 800 |
| — | CL | 20 | 365 | 400 md | 0.42 | 215 | SS | TL | GC | — | — | — |
| — | SL | — | 95 | 150 md | 1.06 | 205 | SS | Hom | TOC | 6,500 | — | — |
| GLM | SL | 80 | 87 | — | 0.8 | 235 | SS | — | PW | — | — | — |
| — | — | 160 | 9 | — | — | — | Sh | — | IR | — | — | — |
| — | PL | 160 | 6 | — | 0.34 | 250 | Sh | — | IFS | 233 | 0 | 180 |
| MP | SL | 40 | 49 | 3 D | 3,000 | 79 | S | — | PI | — | — | — |
| MP | SL | 40 | 49 | 3 D | 3,000 | 79 | S | — | PI | — | — | — |
| MP | SL | 40 | 49 | 3 D | 3,000 | 79 | S | — | PI | — | — | — |
| — | PL | — | 35 | <1 md | — | — | SS | — | PI | — | — | — |
| — | OH | — | — | — | 250 | 160 | Cal K | F | IFS, CRW | — | — | — |
| — | OH | — | — | — | 250 | 160 | Cal K | F | IFS, CRW | — | — | — |
| — | OH | — | — | — | 250 | 160 | Cal K | F | IFS, CRW | 4,530/<br>2,460* | — | — |
| — | OH | — | — | — | 250 | 160 | Cal K | F | IFS, CRW | 9,140/<br>8,040* | | |
| — | OH | — | — | — | 250 | 160 | Cal K | F | IFS, CRW | 4,030/<br>3,320* | | |
| — | OH | — | 394 | — | 250 | 160 | Cal K | F | IFS, CRW | 3,570/<br>350* | | |
| — | OH | — | 410 | — | 250 | 160 | Cal K | F | IFS, CRW | 1,650/<br>530* | | |
| — | OH | — | 460 | -- | 250 | 160 | Cal K | F | IFS, CRW | 1,530 | — | — |
| — | OH | 40 | 164 | 100 md | 0.6 | 181 | R, LS, D | — | CS | — | — | — |
| — | UC-Perf. | 640-160 | 12 | — | — | — | C | Hom | PI | 1 | 0 | 500 |
| — | CL | 40 | 540 | 1-3 md | 8.24 | 104 | Ch | CB | PI | 2,450 | <125 | 9,000 |
| — | CL | 40 | 380 | 1-3 md | 8.24 | 104 | Ch | CB | PI | 3,900 | 108 | 3,600 |
| — | CL | 40 | 830 | 1-3 md | 8.24 | 104 | Ch | CB | PI | 2,100 | <100 | 9,600 |
| — | CL | 700 m | 50 | 1 md | 0.025 | 160 | Ch | TM | TOC | 400 | 80 | 10,000 |
| — | -- | 320 | 22 | — | — | — | Coal | F | IFS | — | — | — |
| — | PL | 320 | 20 | — | — | — | Coal | F | IFS | 0 | 50 | 115 |
| RP | PC | 40 | 36 | — | 41 | 60 | C | DS | PI | 226 | 102 | 271 |
| RP | PC | 160/80 | 15 | — | 54 | 60 | C | DS | PI | 36 | 160 | 60 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 449 | 0 | 131 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 156 | 0 | 41 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 22 | 0 | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | SH | F | IFS | — | — | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 325 | 0 | 36 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 205 | 0 | 120 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 231 | 0 | 161 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 185 | 0 | 160 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 142 | 0 | 80 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 19 | 0 | 10 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 373 | 1 | 400 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 46 | 0 | 10 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 276 | 0 | 308 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 235 | 0 | 247 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | — | — | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | — | — | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | — | — | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 571 | 2 | 700 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 298 | 0 | 274 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | — | — | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 180 | 0 | 60 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 423 | 2 | 450 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 190 | 0 | 190 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 44 | 17 | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 553 | 0 | 463 |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 153 | 0 | — |
| — | SL | 160 | 1-8 | 1 md | 0.30 | 240 | Sh | F | IFS | 24 | 13 | 9 |
| — | SL | — | 56 | 1-4 D | 100,000 | 72 | US | Hom | IR | — | — | — |
| — | PGLP | — | 72 | 8 D | 0.35 | 158 | SS | -- | GC | 30,000 | — | — |
| F, ESP, GL, RP | OH, SL | 80 | 600 | — | — | — | LS, Ch | F | IFS | 80-3,262 | — | — |
| — | PC | 160 | 6 | — | 0.31 | 250 | SH | F | IFS | 15 | — | — |
| GL | OH, PL | — | 600 | — | — | — | Ch | F | IFS | — | — | — |

# Horizontal well survey (continued)

| Company | Field, location | Well number | Present status of the well | Completion date | Total days, drill and complete | True vertical depth, ft | Horizontal displacement, ft | Maximum inclination, degrees | Length drilled horizontally in reservoir, ft | Length of pay, ft | Top drive | Maximum buildup rate, degrees | Mud type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Saskoil | Plover Lake, Sask. | 4 wells | P | 12/89 | 11-20 | 2,673 | 2,066-3,293 | 91 | 1,131-2,358 | — | no | 6/100 ft | PM |
| Sceptre Res. | Tangleglags N., Sask. | 1 | P | 10/87 | 23 | 1,562 | 2,753 | 93 | 1,381 | 1,381 | no | 9.4/30 m | FW, PM |
| Sceptre Res. | Gainsrough N., Sask | 2 | F | 10/89 |  | 3,524 | 1,621 | 93 | 1,621 | 1,621 | no | 11.7/30 m | KC1 |
| SELM | Vega, Off. Sicily | 20 | P | 10/88 | 94 | 8,314 | 7,182 | 95 | 1,896 | 1,896 | yes | 4.3/100 ft | PM |
| SELM | Vega, Off. Sicily | 18 | P | 12/89 | 12 | 8,625 | 1,191 | 95.6 | 1,053 | 1,269 | no | 51.5/100 ft | PM |
| Shell Int. | Rabi, Gabon | Rb-53 | P | 7/89 | 44 | 3,661 | 4,797 | 92 | 1,870 | 1,870 | no | 2.2/10 m | SW |
| Shell Int. | L-Block, North Sea | L13-FD103 | T | 12/89 | 195 | 11,484 | 10,040 | 83 | 2,658 | 2,858 | yes | 1.5/10 m | OBM |
| Shell Int. | Midale, Sask. | C3-5 | P | 12/89 | 32 | 4,708 | 1,119 | 94 | 1,063 | 545 | no | 23/30 m | BM |
| Shell Int. | Midale, Sask. | C3-14[†] | D | — | 25 | 4,626 | 1,657 | 95 | 1,066 | — | no | 24/30 m | BM |
| Shell Int. | Midale, Sask. | C9-23 | P | 8/89 | 78 | 4,577 | 1,181 | 90 | 837 | 486 | no | 22/30 m | KCL |
| Shell Int. | ERB West, Sabah | EW-204[†] | D | 3/90 | 63 | 6,880 | 4,175 | 90 | 1,775 | 1,400 | yes | 10/100 ft | DBM |
| Shell Int. | EW 209, Malaysia | EW-209[†] | S | 5/90 | — | 6,880 | 4,995 | 90 | 3,000 | 2,000-2,400 | yes | 10/100 ft | OBM |
| Shell Int. | ERB West, Sabah | EW-211[†] | D | 2/90 | 55 | 6,880 | 3,944 | 90 | 2,800 | 2,800 | yes | 5/100 ft | OBM |
| Texaco | Wildcat, N.D. | Thompson[†] Unit No. 5-1 | D | — | — | 11,054 | 3,200 | 90 | 2,500 | 2,500 | no | 14/100 ft | OBM |
| Union Pac. | Giddings, Tex. | Lydia Rubach #1 | F | 11/89 | 34 | 8,712 | 2,695 | 91.5 | 2,257 | 2,557 | no | 18.5/100 ft | FW, SW |
| Union Pac. | Giddings, Tex. | D. Stefka No. 1 | P | 10/89 | 46 | 7,362 | 2,324 | 90 | 2,060 | 2,060 | no | 17.8/100 ft | FW, SW |
| Union Pac. | Giddings, Tex. | W. Lightsey No. 2 | P | 11/89 | 26 | 7,174 | 2,600 | 91.2 | 2,371 | 2,371 | no | 18.4/100 ft | FW, SW |
| Union Pac. | Giddings, Tex. | J.D. McKinney No. 1 | F | 8/89 | 36 | 8,087 | 1,572 | 96.5 | 1,387 | 1,387 | no | 14.7/100 ft | FW, SW |
| Union Pac. | Giddings, Tex. | Peter Court No. 2 | P | 12/88 | 33 | 7,895 | 1,700 | 94.1 | 1,570 | 1,570 | no | 21.6/100 ft | FW, SW |
| Union Pac. | Giddings, Tex. | E. Rychlik A-2 | P | 1/89 | 27 | 7,516 | 1,656 | 94.5 | 1,420 | 1,420 | no | 15.2/100 ft | FW, SW |
| Unocal | Point Pedernales, Off. Calif. | A-17 | P | 9/89 | 37 | 4,491 | 11,362 | 79.5 | 2,355 | 2,355 | yes | 7.1/100 ft | LS, ND |
| Unocal | Ponit Pedernales, Off. Calif. | A-16 | P | 8/89 | 53 | 4,420 | 12,740 | 87.5 | 5,743 | 5,743 | yes | 6.8/100 ft | LS, ND |
| Unocal | Haven, Off. Nether. | A-1 | P | 11/89 | 34 | 5,332 | 3,150 | 104 | 2,126 | 2,067 | yes | 12.5 | OBM |
| Unocal | Haven, Off. Nether. | A-2 | P | 12/89 | 18 | 5,361 | 2,392 | 93.2 | 1,673 | 1,641 | yes | 12.5 | OBM |
| Western Min. | South Pepper, Off. Australia | 8 | P | 9/89 | 36 | 4,042 | 2,372 | 91 | 1,542 | 1,266 | no | 6/30 m | — |
| Western Min. | South Pepper, Off. Australia | 7 | P | 4/89 | 27 | 4,045 | 4,193 | 92 | 2,139 | 1,660 | no | 6.3/30 m | PM, SW |
| Western Min. | South Pepper, Off. Australia | 6 | P | 1/88 | 17 | 4,045 | 3,599 | 91 | 1,588 | 1,030 | no | 3.7/30 m | PM, SW |
| Western Min. | Chervil, Off. Australia | 5 | P | 6/89 | 24 | 3,455 | 3,527 | 92 | 2,356 | 1,982 | yes | 6.5/30 m | PM, SW |
| Western Min. | Chervil, Off. Australia | 4 | P | 8/89 | 32 | 3,471 | 2,828 | 92 | 1,191 | 768 | yes | 6.6/30 m | PM, SW |
| Western Min. | North Herald, Off. Australia | 3 | P | 11/89 | 24 | 3,940 | 2,389 | 89 | 1,148 | 1,148 | no | 6.5/30 m | PM, SW |
| Winn Expl. | Pearsall, Tex. | Leta Glasscock No. 10 | F | 11/89 | 18 | 6,633 | 2,500 | 87 | 2,500 | 2,500 | no | 14.5/100 | FW, SW |
| Winn Expl. | Pearsall, Tex. | Leta Glasscock No. 12 | F | 12/89 | 24 | 6,531 | 3,003 | 87 | 3,003 | 3,003 | no | 14.5/100 | FW |

*Initial/current

†Drilling data are planned, not actual

Oryx expects to be producing 15,000-20,000 bo/d from the Austin chalk.

Table 1, from Oryx's application to change the field rules, demonstrates the substantial increase in production that can be obtained from horizontal drilling.

The Pearsall field also provides a good case study for horizontal drilling potential in reservoirs that previously had been exploited. Since 1936, almost 2,000 wells have been drilled in the field, and the cumulative oil production is nearly 60 million bbl or just 30,000 bbl/well.

More than half of these wells were drilled because of advances in hydraulic fracturing technology in the mid-1970s, followed by the drilling boom resulting from oil prices jumping to $30/bbl during the early 1980s.

Now in the new boom, some wells with horizontal laterals have already exceeded cumulatives of 100,000 bbl, and some might have surpassed 300,000 bbl.

Oryx's well J.B. Baggett No. 13 with a 2,250-ft horizontal drainhole produced 112,400 between the completion date in April 1988 and Aug. 13, 1989.

The ultimate recovery is expected to be about 375,000 bbl.

The initial potentials of a number of wells are also impressive. Oryx's Heitz No. 1 tested 3,262 bo/d, and Winn Exploration Co.'s Leta Glasscock No. 10 flowed 5,472 bo/d. GLC Energy Inc.'s C.A. Beaver No. 1 in 24 hr tested over 3,000 bo/d, and during the initial 90-min test recorded rates of around 6,400 bo/d.

### Field rules change

The Texas Railroad Commission's temporary field rules for the Pearsall (Austin chalk) field will allow producing the horizontal wells at about 4.1 bo/d/acre. The acreage is determined in increments of 40 acres and calculated by the formula A = (L × 0.08126) + 80. A equals the calculated area assignable to a horizontal drainhole for proration purposes. L is the horizontal distance, in feet, between the point at which the drainhole penetrates the top of the Austin chalk and the horizontal drainhole end point within the Austin chalk.

As an example, wells with L of 1,477 – 1,968 ft are assigned a proration acreage of 240 acres. For an L of 2,953 – 3,444 ft, the assigned

| Artificial lift | Completion | Spacing, acres | Pay thickness, ft | Permeability | Viscosity, cp | Temperature, °F. | Reservoir rock | Main reservoir heterogeneity | Reason for horizontal drilling | Oil production, b/d | Water production, bw/d | Gas production, Mcfd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCP | SL | 40 | 39 | 3 D | 1,700 | 82 | US | F | PI | — | — | — |
| RP | SL | 40 | 27 | 4 D | 13,000 | 66 | US | Hom/ Disc Sh | IR | 600 | 3,000 | — |
| — | SL | 80 | 24 | 100 md | 2.3 | 108 | LS | TS | IR | 1,100 | 40 | 165 |
| ESP | OH | 70 | 656 | — | 200 | 203 | LS | F | PI, IFS, WC | 2,500 | — | — |
| ESP | OH | 70 | 656 | — | 200 | 203 | LS | F | PI, IFS, WC | 1,500 | — | — |
| — | PGPL | — | 153 | 2 D | 2.5 | 111 | SS | Sh | IR, CRG | 7,500 | — | — |
| — | CL | — | 469 | — | — | — | SH, SH | Disc. SH | IR | — | — | — |
| ESP | OH | 40 | 69 | — | — | 131 | C, LS | F | IFS | — | — | — |
| ESP | OH | 40 | 69 | 1-10 md | — | — | C, LS | F | IFS | — | — | — |
| ESP, RP | CL | 40 | 69 | 1-10 md | 30 | 131 | C, LS | F | FS | — | — | — |
| GL | CL | — | 50 | 100 md-2 D | 0.45 | 200 | Si, Sh, SS | — | IR, GC, PI, TOC, WC | 5,000 | — | — |
| GL | CL | — | 50 | 100 md-2 D | 0.45 | 200 | Si, Sh, SS | — | IR, GC, PI, TOC, WC | 5,000 | — | — |
| GL | CL | — | 50 | 100 md-2 D | 0.45 | 200 | Si, Sh, SS | — | IR, GC, PI, TOC, WC | 5,000 | — | — |
| — | OH | 640 | 10 | — | — | — | Sh | F | IFS | | | |
| — | PL | 80 | 30 | — | — | — | Ch | F | — | 569 | — | 1,632 |
| RP | PL | 80 | 30 | — | — | — | Ch | F | — | 351 | — | 141 |
| RP | PL | 80 | 30 | — | — | — | Ch | F | — | 255 | — | 129 |
| RP | PL | 80 | 30 | — | — | — | Ch | F | — | 464 | — | 569 |
| RP | PL | 80 | 30 | — | — | — | Ch | F | — | 418 | — | 312 |
| RP | PL | 80 | 30 | — | — | — | Ch | F | — | 539 | — | 255 |
| GL | OH | 80 | 671 | 20 md-10 D | 40 | 205 | SH | F | IFS, IR | 2,671 | 21 | 517 |
| GL | CL | 80 | 1,101 | 20 md-10 D | 40 | 205 | Sh | F | IFS, IR | 2,095 | 29 | 529 |
| ESP | GPS | — | — | — | — | — | — | — | — | — | — | — |
| ESP | GPS | — | — | — | — | — | — | — | — | — | — | — |
| GL | PL | — | 36 | >5 D | — | — | SS | Hom | PI, GC, WC | 2,350 | 330 | 4,300 |
| GL | PL | — | 36 | >5 D | — | — | SS | Hom | PI, GC, WC | 1,500 | 1,380 | 1,000 |
| GL | PL | — | 36 | >5 D | — | — | SS | Hom | PI, GC, WC | 1,500 | 193 | 3,400 |
| GL | PL | — | 25 | >5 D | — | — | SS | Hom | PI, GC, WC | 3,200 | 37 | 900 |
| GL | PL | — | 25 | >5 D | — | — | SS | Hom | PI, GC, WC | 1,950 | 360 | 1,000 |
| GL | PL | — | 43 | >5 D | — | — | SS | Hom | PI, GC, WC | 3,200 | 3,800 | 1,900 |
| — | SL | 320 | 500 | — | — | — | Ch | F | IFS | 5,472 | — | 2,368 |
| — | OH | 360 | 500 | — | — | — | Ch | F | IFS | 3,600 | 356 | 1,980 |

acres is 360. In these two cases the maximum daily oil allowable is 984 and 1,476 bo/d, respectively.

If multiple laterals are drilled, the temporary field rules allow the summation of the lengths if the angle between the laterals is greater than 90°. The temporary field rules were effective on Aug. 22, 1989, and will remain in effect until Aug. 22, 1990.

### Drilling while producing

One of the unique features of drilling in the Pearsall field is that hydrocarbons are commonly produced while extending the well laterally. Most of these wells are drilled with fresh water or brine to prevent formation damage. Because of either lost circulation into fractures that had previously produced, or encountering fractures with higher pressures, both oil and gas will enter the well bore during drilling operations.

Rigs are typically equipped to flow oil to storage and gas to a flare. Drilling while holding pressure on the annulus is common. To date, no major problems have occurred, although any time hydrocarbons are around the drill floor there is a reason to excercise utmost caution.

## Other activity

Another horizontal drilling boom is the fractured Bakken shale in North Dakota. Meridian Oil Co. is the most active operator in seeking to develeoped the 1 to 8-ft thick reservoir.

Production rates are not as spectacular as in the Pearsall field, but some wells are producing above 500 bo/d. As Meridian has gained experience in drilling horizontal wells, costs for these wells have decreased from 2.5 times to 1.2 times the cost of a vertical well.

During 1991-92, Elf Aquitaine has plans to add a third platform in the Rospo Mare field in the Adriatic that will be developed with 16 horizontal wells.

For 1990, Elf plans to drill about one horizontal well per month.

In January 1990, three horizontal wells (Oman, Angola, and Rospo Mare) were being drilled.

The six wells listed for Alberta Oil Sands Technology & Research Authority (Aostra) were drilled in a novel approach from underlying tunnels. The oil in the reservoir is highly viscous, 1 million cp at 50° F. Steam is used to stimulate the production. Although the producing rates are confidential, Aostra does indicate that the results from this small-scale pilot are excellent and that future plans for 1990 include drilling six more wells at the same site. The horizontal length of the new wells is planned to exceed 1,000 ft.

Saskatchewan is the only place that had wells (listed in Table 4) completed with multiple tubing strings. Both of Sceptre Resources Ltd.'s wells, and Mobil Oil Canada's well, had two strings of tubing.

Coring is not common. Only eight wells in our survey had cores taken; three were drilled by Maersk Olie OG Gas AS off Denmark, three by Shell, and one each by Husky Oil and Mobil. The Shell and Mobil wells were all in Saskatchewan.

Eleven wells in the survey were hydraulically fractured, some with acid. Four of these jobs were done by Maersk in its wells offshore Denmark. Another three were perfomed by Union Pacific Resources in the Giddings field, Texas. Eight wells were acidized.

## 1990 plans

Horizontally drilled wells are still a small percentage of the approximately 50,000 plus yearly worldwide completions (not including the U.S.S.R. and some Eastern European countries). But the number, as shown in Tables 2 and 3, is growing.

In Table 2 our survey shows that in 1990, 39 companies plan to drill 376-393 wells with horizontal lengths greater than 1,000 ft. Laterals shorter than 1,000 ft are definitely less attractive. From Table 3, only 14 companies have plans to drill 26-28 wells of this type.

As was mentioned earlier, the frantic drilling activity in the Austin chalk is difficult to tabulate at this time. Possibly several hundred more horizontal wells could be drilled there during 1990.

This Texas setting of an old time drilling boom is a fitting preamble to mushrooming activity that is becoming more international in scope. ▪

# Annual refining survey

**Lou Ann Thrash**
Director of Editorial Surveys

For a better understanding of the survey the following information may be of help.

Calendar-day figures reported in this survey are the average volume a refinery unit processes each day including downtime used for turnarounds. This is actual total volume for the year divided by 365.

Stream-day figures represent the amount a unit can process when running full capacity for short periods.

This survey includes only facilities charging whole crude, plus lube plants not charging whole crude.

**Totals.** When an asterisk (*) appears beside a figure in the crude capacity columns, this indicates that the figure was not reported but has been converted into either a calendar-day or stream-day figure using the crude conversion factor of 0.95.

**Legend.** Hydrocracking includes those processes where 50% or more of the feed is reduced in molecular size; for hydrorefining 10% of the feed or less is reduced in molecular size; and for hydrotreating, essentially no reduction in molecular size of feed occurs.

Values for hydrogen volumes represent either generation or upgrading to 90+ % purity.

Catalytic reforming definitions are:

- Semiregenerative is characterized by shutdown of the reforming unit at specified intervals or at the operator's convenience for regeneration of catalyst in situ.
- Cyclic is characterized by continuous or continual regeneration of catalyst in situ in any one of several reactors that can be isolated from and returned to the reforming operation. This is accomplished without changing feed rate or octane.
- Other includes: Nonregenerative—catalyst replaced by fresh catalyst; continuous — continuous regeneration of a part of the catalyst in a special regenerator followed by continuous addition to the reactor; moving-bed catalyst systems.

Detailed U.S. breakdown by company, plant, and state starts on the next page. Included are:

- U.S. crude distillation and downstream capacity by states.
- Detailed distillation and downstream capacities by U.S. refinery.
- List of refineries that became inactive during the survey year.

## Legend

**Numbers identify processes in table**

**THERMAL PROCESSES**
1. Gas-oil cracking
2. Thermal cracking
3. Visbreaking
4. Coking (fluid)
5. Coking (delayed)
6. Other

**CATALYTIC CRACKING**
1. Fluid
2. Other

**CATALYTIC REFORMING**
- Semiregenerative:
  1. Conventional catalyst
  2. Bimetallic catalyst
- Cyclic:
  3. Conventional catalyst
  4. Bimetallic catalyst
- Other:
  5. Conventional catalyst
  6. Bimetallic catalyst

**CATALYTIC HYDROCRACKING**
1. Distillate upgrading
2. Residual upgrading
3. Lube-oil manufacturing
4. Other

**CATALYTIC HYDROREFINING**
1. Residual desulfurizing
2. Heavy gas-oil desulfurizing
3. Cat-cracker and cycle-stock feed pretreatment
4. Middle distillate
5. Other

**CATALYTIC HYDROTREATING**
1. Pretreating cat-reformer feeds
2. Naphtha desulfurizing
3. Naphtha olefin or aromatics saturation
4. Straight-run distillate
5. Other distillate
6. Lube-oil "polishing"
7. Other

**ALKYLATION**
1. Sulfuric acid
2. Hydrofluoric acid

**AROMATICS/ISOMERIZATION**
1. BTX
2. Hydrodealkylation
3. Cyclohexane
4. $C_4$ feed
5. $C_5$ feed
6. $C_5$ and $C_6$ feed

**HYDROGEN**
1. Steam methane reforming
2. Steam naphtha reforming
3. Partial oxidation
4. Cryogenic
5. Other

# Survey of operating refineries in the U.S. (state capacities as of Jan. 1, 1990)

| | | | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | — Crude capacity — | | | | — Cat cracking — | | | | | | | | | | | |
| State | No. plants | b/cd | b/sd | Vacuum distillation | Thermal operations | Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Alabama | 3 | 139,250 | 143,300 | 49,000 | 12,000 | ...... | ...... | 26,000 | ...... | 29,800 | 27,500 | ...... | 7,000 | ...... | 19,500 | 6.0 | 400 |
| Alaska | 6 | 231,000 | 242,700 | 6,000 | 26,000 | ...... | ...... | 12,000 | 9,000 | ...... | 12,000 | ...... | 6,500 | ...... | 8,000 | 12.8 | ...... |
| Arizona | 2 | 13,710 | 14,000 | 8,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3,500 | 1,000 | ...... | ...... |
| Arkansas | 3 | 58,570 | 61,000 | 30,500 | ...... | 18,500 | 775 | 9,000 | ...... | ...... | 20,000 | 4,800 | 3,000 | 4,000 | 9,700 | 2.8 | ...... |
| California | 30 | 2,222,248 | 2,359,700 | 1,312,295 | 504,600 | 654,000 | 14,000 | 535,500 | 391,500 | 538,500 | 937,100 | 131,000 | 18,200 | 29,400 | 89,354 | 1,030.4 | 20,157 |
| Colorado | 3 | 91,200 | 101,000 | 41,100 | 4,200 | 25,500 | 1,000 | 22,400 | 5,000 | ...... | 34,200 | 3,800 | ...... | ...... | 5,000 | 6.0 | 200 |
| Delaware | 1 | 140,000 | 150,000 | 95,000 | 46,000 | 65,000 | 5,000 | 56,000 | 19,000 | ...... | 110,000 | 13,500 | ...... | ...... | ...... | 40.0 | 2,180 |
| Georgia | 2 | 35,500 | 38,200 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 26,500 | ...... | ...... |
| Hawaii | 2 | 129,800 | 135,000 | 71,250 | 13,000 | 20,000 | ...... | 12,000 | 16,000 | ...... | 14,500 | 5,625 | 1,500 | ...... | 2,400 | 20.1 | ...... |
| Illinois | 6 | 920,600 | 977,000 | 361,000 | 124,400 | 343,000 | 12,000 | 290,300 | 66,000 | 35,000 | 527,300 | 91,000 | 30,900 | 4,600 | 36,600 | 66.8 | 6,300 |
| Indiana | 4 | 426,900 | 441,500 | 233,200 | 27,500 | 166,500 | 4,000 | 99,500 | ...... | 80,000 | 176,800 | 33,700 | 37,000 | 6,400 | 46,000 | ...... | 1,550 |
| Kansas | 8 | 348,125 | 368,683 | 126,650 | 52,000 | 127,500 | 5,000 | 93,800 | 3,190 | 44,000 | 164,000 | 39,100 | 41,000 | ...... | 4,500 | ...... | 2,070 |
| Kentucky | 2 | 218,900 | 226,300 | 92,000 | 57,600 | 100,000 | ...... | 53,000 | 400 | 40,000 | 142,700 | 13,000 | 17,600 | 8,000 | 30,000 | ...... | ...... |
| Louisiana | 17 | 2,272,415 | 2,370,900 | 903,300 | 418,700 | 783,500 | 11,300 | 494,900 | 149,000 | 277,000 | 972,600 | 206,300 | 99,800 | 38,500 | 55,400 | 167.6 | 15,025 |
| Michigan | 4 | 123,700 | 134,095 | 30,000 | ...... | 46,500 | 1,300 | 33,500 | ...... | 21,800 | 44,000 | 10,000 | 7,000 | ...... | 10,000 | ...... | ...... |
| Minnesota | 2 | 285,600 | 299,220 | 192,000 | 58,000 | 78,000 | 1,000 | 55,500 | ...... | 86,500 | 127,000 | 19,150 | 23,300 | ...... | 49,000 | 20.0 | 2,800 |
| Mississippi | 5 | 358,600 | 378,879 | 278,600 | 70,000 | 74,000 | ...... | 95,800 | 68,000 | 194,000 | 59,800 | 19,700 | 5,500 | 5,000 | 40,600 | 217.5 | 3,450 |
| Montana | 4 | 138,900 | 145,700 | 54,800 | 7,700 | 53,900 | 7,700 | 37,700 | 4,900 | 14,000 | 101,500 | 12,700 | 6,450 | ...... | 24,700 | 19.3 | 435 |
| Nevada | 1 | 4,500 | 4,700 | 2,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| New Jersey | 6 | 494,250 | 517,947 | 249,400 | 31,500 | 256,000 | 25,000 | 78,500 | ...... | 65,000 | 239,600 | 31,500 | 27,000 | 8,500 | 73,000 | 11.0 | 1,010 |
| New Mexico | 3 | 80,300 | 84,932 | 13,900 | 1,000 | 27,700 | 6,600 | 21,100 | 1,000 | ...... | 30,300 | 5,400 | 4,000 | ...... | 4,100 | ...... | ...... |
| New York | 1 | 42,500 | 45,000 | 27,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | .... | ...... | ...... |
| North Dakota | 1 | 58,000 | 60,000 | ...... | ...... | 26,000 | 5,200 | 12,100 | ...... | ...... | 16,600 | 4,600 | 4,000 | ...... | ...... | ...... | ...... |
| Ohio | 4 | 482,650 | 508,000 | 163,000 | 29,900 | 176,000 | 8,800 | 160,600 | 86,200 | 23,000 | 169,500 | 29,400 | 65,400 | 2,100 | 19,000 | 65.0 | 1,250 |
| Oklahoma | 6 | 391,500 | 409,316 | 145,500 | 20,500 | 144,500 | 5,840 | 94,500 | 5,000 | 21,000 | 146,500 | 36,100 | 29,400 | 10,000 | 13,100 | 10.0 | 1,260 |
| Oregon | 1 | 15,000 | 15,789 | 16,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 11,500 | ...... | ...... |
| Pennsylvania | 9 | 856,000 | 908,000 | 403,180 | ...... | 268,300 | 6,800 | 258,820 | 81,000 | 50,000 | 558,900 | 47,000 | 21,050 | 21,310 | 78,000 | 89.5 | ...... |
| Tennessee | 1 | 60,000 | 62,000 | 12,000 | ...... | 30,000 | ...... | 10,000 | ...... | ...... | 31,000 | 5,500 | 4,000 | ...... | 3,500 | ...... | ...... |
| Texas | 31 | 3,992,750 | 4,243,800 | 1,791,300 | 363,400 | 1,648,800 | 132,250 | 1,156,700 | 281,000 | 824,000 | 2,292,350 | 315,500 | 310,815 | 90,600 | 55,400 | 623.0 | 11,506 |
| Utah | 6 | 154,500 | 160,400 | 48,100 | 8,500 | 55,400 | 9,100 | 31,100 | ...... | 7,100 | 34,100 | 14,300 | 8,050 | ...... | 1,700 | ...... | 350 |
| Virginia | 1 | 53,000 | 56,000 | 29,000 | 13,500 | 27,500 | 2,000 | 10,200 | ...... | ...... | 26,000 | 2,400 | ...... | ...... | ...... | ...... | 750 |
| Washington | 7 | 492,675 | 512,517 | 240,500 | 72,000 | 112,500 | 12,000 | 119,800 | 52,000 | 25,500 | 180,000 | 28,300 | 4,250 | ...... | 16,600 | 80.0 | 3,700 |
| West Virginia | 2 | 29,680 | 30,800 | 10,850 | ...... | ...... | ...... | 4,900 | 4,500 | ...... | 3,900 | ...... | ...... | 6,440 | ...... | 1.2 | ...... |
| Wisconsin | 1 | 32,000 | 34,000 | 20,500 | ...... | 11,000 | 1,000 | 8,000 | ...... | 5,800 | 9,000 | 1,300 | 2,000 | ...... | 13,500 | ...... | ...... |
| Wyoming | 5 | 164,600 | 171,500 | 75,100 | 8,400 | 64,500 | 10,200 | 37,250 | ...... | 29,000 | 54,550 | 10,500 | 1,200 | 1,500 | 13,000 | ...... | ...... |
| **Total** | **190** | **15,558,923** | **16,411,878** | **7,132,525** | **1,972,400** | **5,404,100** | **287,865** | **3,930,470** | **1,242,690** | **2,411,000** | **7,263,300** | **1,135,175** | **785,915** | **240,350** | **760,654** | **2,489.0** | **74,393** |

# U.S. refineries: location, capacities, types of processing

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| **ALABAMA** | | | | | | | | | | | | | | | | |
| Belcher Refining Co.—Mobile Bay | *14,250 | 15,000 | 14,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 10,000 | ...... | ...... |
| Hunt Refining Co.—Tuscaloosa | 45,000 | 47,000 | 15,000 | $^{5}$12,000 | ...... | ...... | $^{2}$6,000 | ...... | $^{2}$9,800<br>$^{4}$5,000 | $^{1}$6,000<br>$^{3}$1,500 | ...... | ...... | ...... | 9,500 | $^{1}$6.0 | 400 |
| Louisiana Land & Exploration Co.—Saraland | 80,000 | 81,300 | 20,000 | ...... | ...... | ...... | $^{2}$20000 | ...... | $^{3}$15,000 | $^{2}$2,000 | ...... | $^{6}$7,000 | ...... | ...... | ...... | ...... |
| **Total** | **139,250** | **143,300** | **49,000** | **12,000** | ...... | ...... | **26,000** | ...... | **29,800** | **27,500** | ...... | **7,000** | ...... | **19,500** | **6.0** | **400** |
| **ALASKA** | | | | | | | | | | | | | | | | |
| ARCO Alaska Inc.—Kuparuk | 12,000 | 12,000 | ...... | $^{6}$12,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Prudhoe Bay | 16,000 | 16,000 | ...... | $^{6}$16,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Chevron U.S.A. Inc.—Kenai | 22,000 | 22,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 6,000 | ...... | ...... |
| Mapco Alaska Petroleum—North Pole | 102,000 | 105,000 | 6,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | $^{1}$2,500 | ...... | 2,000 | ...... | ...... |
| Petro Star Inc.—North Pole | 7,000 | 7,200 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Tesoro Petroleum Corp.—Kenai | 72,000 | 80,000 | ...... | ...... | ...... | ...... | $^{4}$12,000 | $^{2}$9,000 | ...... | $^{1}$12,000 | ...... | $^{6}$4,000 | ...... | ...... | $^{1}$12.8 | ...... |
| **Total** | **231,000** | **242,700** | **6,000** | **28,000** | ...... | ...... | **12,000** | **9,000** | ...... | **12,000** | ...... | **6,500** | ...... | **8,000** | **12.8** | ...... |
| **ARIZONA** | | | | | | | | | | | | | | | | |
| Intermountain Refining CI—Fredonia | *5,710 | 6,000 | 2,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1,000 | ...... | ...... |
| Sunbelt Refining Co.—Randolph | 8,000 | 8,000 | 6,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3,500 | .... | .... | .... |
| **Total** | **13,710** | **14,000** | **8,000** | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | **3,500** | **1,000** | ...... | ...... |
| **ARKANSAS** | | | | | | | | | | | | | | | | |
| Berry Petroleum Co.—Stevens | 3,800 | 4,000 | 1,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1,000 | ...... | ...... |
| Cross Oil & Refining Co. of Arkansas—Smackover | 6,770 | 7,000 | 4,000 | ...... | ...... | ...... | ...... | ...... | ...... | $^{6}$4,500 | ...... | ...... | 4,000 | 2,200 | $^{1}$2.8 | ...... |
| Lion Oil Co.—El Dorado$^{1}$ | 48,000 | 50,000 | 25,000 | ...... | $^{1}$18,500 | 775 | $^{2}$9,000 | ...... | ...... | $^{1}$10,000<br>$^{5}$5,500 | $^{1}$4,800 | $^{6}$3,000 | ...... | 6,500 | ...... | ...... |
| **Total** | **58,570** | **61,000** | **30,500** | ...... | **18,500** | **775** | **9,000** | ...... | ...... | **20,000** | **4,800** | **3,000** | **4,000** | **9,700** | **2.8** | ...... |

Solvent extraction: $^{1}$5,500 b/d.

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| **CALIFORNIA** | | | | | | | | | | | | | | | | |
| Anchor Refining Co. Inc.—McKittrick | 10,000 | 11,000 | 7,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 7,000 | ...... | ...... |
| Atlantic Richfield Co.—Carson | 220,000 | 232,000 | 112,000 | $^{5}$56,000 | $^{1}$82,000 | ...... | $^{2}$48,000 | $^{1}$22,000 | ...... | $^{1}$40,000<br>$^{2}$10,000<br>$^{4}$18,000<br>$^{5}$8,000<br>$^{7}$75,000 | $^{1}$14,000<br>3,000 | ...... | ...... | ...... | $^{1}$70.0 | 2,500 |
| Chemoil Refining Corp.—Signal Hill | 14,200 | 15,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | |
| Chevron U.S.A. Inc.—El Segundo | 286,000 | 327,000 | 114,000 | $^{4}$54,000 | $^{1}$62,000 | ...... | $^{2}$51,000 | $^{1}$45,000 | $^{1}$24,000<br>$^{2}$60,000<br>$^{4}$14,000 | $^{1}$56,000<br>$^{4}$14,000 | $^{1}$8,000 | ...... | ...... | ...... | $^{2}$130.0 | 2,900 |
| Richmond$^{1}$ | 270,000 | 280,000 | 175,000 | ...... | $^{1}$63,000 | ...... | $^{2}$50,000 | $^{1}$45,000<br>†$^{2}$30,000<br>$^{3}$30,500 | $^{2}$60,000<br>$^{4}$65,000 | $^{1}$66,000<br>$^{6}$18,200 | $^{1}$7,000<br>*2,000 | ...... | 11,000 | 11,000 | $^{1}$150.0 | ...... |

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Conoco Inc.—Santa Maria | 9,500 | 10,000 | 7,800 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 6,800 | ...... | ...... |
| Edgington Oil Co. Inc.—Long Beach | 41,600 | 44,730 | 21,165 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 15,554 | ...... | ...... |
| Exxon Co.—Benicia | 128,000 | 132,000 | 67,000 | [4]27,500 | [1]64,000 | 11,000 | [3]32,000 | [1]32,000 | [1]37,000 | [1]27,000<br>[2]22,000<br>[4]12,500<br>[5]12,500<br>[7]17,000 | [1]14,000<br>*2,000 | ...... | ...... | ...... | [1]104.0 | 1,100 |
| Fletcher Oil & Refining Co.—Carson | 26,500 | 27,000 | 17,000 | ...... | [1]12,000 | ... | [4]5,000 | ...... | [2]12,000 | [1]5,000 | ...... | ...... | ...... | ...... | ...... | ...... |
| Golden Bear Division, Witco Chemical Corp.—Oildale | 10,348 | 11,000 | 10,230 | ...... | ...... | ...... | ...... | ...... | ...... | [6]900 | ...... | ...... | 5,100 | 4,000 | ...... | ...... |
| Golden West Refining Co.—Santa Fe Springs | 40,600 | 42,300 | 25,000 | [3]13,800 | [1]13,500 | ...... | [2]19,000 | [1]11,000 | ...... | [2]12,000 | [2]3,000 | ...... | ...... | 4,000 | [1]11.0 | ...... |
| Huntway Refining Co.—Benicia | 8,400 | 9,000 | 7,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 4,500 | ...... | ...... |
| Wilmington | 5,500 | 6,000 | 5,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3,500 | ...... | ...... |
| Kern Oil & Refining Co.—Bakersfield | 20,000 | 22,000 | ...... | ...... | ...... | ...... | [2]3,000 | ...... | ...... | [1]4,500 | ...... | ...... | ...... | ...... | ...... | ...... |
| Lunday-Thagard Co.—South Gate | 7,000 | 7,370 | 7,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Mobil Oil Corp.—Torrance | 123,000 | 130,000 | 95,000 | [5]48,000 | [1]63,000 | ...... | [2]36,000 | [1]21,700 | [3]68,000 | [1]21,000<br>[3]16,000<br>[4]28,000 | [2]17,000 | ...... | ...... | ...... | [1]137.0 | 2,900 |
| Pacific Refining Co.—Hercules | *52,250 | 55,000 | 17,000 | [3]12,000 | ...... | ...... | [2]15,000 | [1]3,500 | ...... | [1]15,000 | ...... | ...... | ...... | ...... | ...... | ...... |
| Paramount Petroleum Corp.—Paramount | 42,700 | 46,500 | 29,000 | ...... | ...... | ...... | [2]10,500 | ...... | [2]11,000 | [2]11,000<br>[4]7,000 | ...... | ...... | ...... | 15,000 | ...... | ...... |
| Powerine Oil Co.—Santa Fe Springs | 46,550 | 49,000 | 26,000 | [5]10,400 | [1]12,500 | ...... | [2]9,000 | [1]8,000 | [3]13,500<br>[4]6,000 | [1]8,500<br>[5]7,000 | [2]3,200 | [4]1,800 | ...... | .... | [1]19.0 | 470 |
| San Joaquin Refining Co.—Bakersfield | 18,000 | 20,000 | 14,000 | [3]10,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 4,000 | 5,000 | ...... | ...... |
| Shell Oil Co.—Martinez | 140,100 | 143,000 | 98,000 | [4]22,000 | [1]67,000 | 1,000 | [3]28,000 | [1]27,000 | [3]50,000 | [1]17,000<br>[3]18,000<br>[4]21,000<br>[6]6,300<br>[7]15,000 | [1]8,000<br>*3,200 | ...... | 4,500 | 11,000 | [1]110.0 | 127 |
| Wilmington | 139,000 | 145,000 | 75,000 | [5]53,000 | [1]42,000 | ...... | [2]24,000 | ...... | [3]11,000 | [2]25,000<br>[3]14,000<br>[4]54,700 | [1]8,600 | ...... | ...... | ...... | [1]36.0 | 2,500 |
| Sunland Refining Corp.—Bakersfield | 15,000 | 15,000 | ...... | ...... | ...... | ...... | [2]1,500 | ...... | ...... | [2]1,500 | ...... | ...... | ...... | ...... | ...... | ...... |
| Ten By, Inc.—Oxnard | 4,000 | 5,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 2,000 | ...... | ...... |
| Texaco Refining & Marketing Inc.— | | | | | | | | | | | | | | | | |
| Bakersfield | 48,000 | 49,000 | 23,000 | [5]13,000 | ...... | ...... | [2]22,000 | [1]14,300 | [2]15,000 | [1]14,000 | ...... | ...... | ...... | ...... | [1]21.0 | 690 |
| Wilmington | 75,000 | 78,400 | 42,000 | [5]48,000 | [1]28,000 | ...... | [2]38,000 | [1]20,000 | ...... | [1]18,000<br>[4]12,000 | [1]4,400 | ...... | ...... | ...... | [3]48.0 | 1,650 |
| Tosco Corp.—Martinez | 131,900 | 143,000 | 118,000 | [4]46,000 | [1]60,000 | 2,000 | [2]20,000<br>[5]23,000 | [1]27,000 | [2]50,000 | [1]12,000<br>[4]22,000 | [1]13,000 | ...... | ...... | ...... | [1]80.0 | 1,500 |
| Ultramar, Inc.—Wilmington | 68,000 | 72,000 | 42,000 | [5]24,000 | [1]38,000 | ...... | [6]14,500 | ...... | [3]42,000 | [1]15,000 | [2]10,500 | [4]9,000 | ...... | ...... | ...... | 1,200 |
| Unocal Corp.—Los Angeles | 108,000 | 111,000 | 83,000 | [3]20,000 | [2]47,000 | ...... | [2]52,000 | [2]22,000 | ...... | [1]54,000<br>[5]36,000 | [1]10,000 | ...... | ...... | ...... | [1]49.4 | ...... |
| Rodeo | 113,100 | 121,400 | 74,100 | [5]46,900 | ...... | ...... | [2]34,000 | [1]32,500 | ...... | [1]23,000<br>[5]12,000<br>[6]14,500 | ...... | [6]7,400 | 4,800 | ...... | [1]65.0 | [illegible] |
| Total | 2,222,248 | 2,359,700 | 1,312,295 | 504,600 | 654,000 | 14,000 | 535,500 | 391,500 | 538,500 | 937,100 | 131,000 | 18,200 | 29,400 | 89,354 | 1,030.4 | 20,157 |

Solvent extraction: [1]50,000 b/sd.

† TKC plant down due to fire. Rebuilt unit scheduled on-line July 1991.

## COLORADO

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Colorado Refining Co.—Commerce City | 28,000 | 35,000 | 10,000 | ...... | [1]8,500 | ...... | [2]9,000 | ...... | ...... | [1]9,000 | *1,200 | ...... | ...... | ...... | ...... | ...... |
| Conoco Inc.—Denver | 48,000 | 50,000 | 23,000 | ...... | [1]17,000 | 1,000 | [2]10,000 | ...... | ...... | [1]10,000<br>[4]11,800 | *2,600 | ...... | ...... | 5,000 | ...... | ...... |

| | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company and location | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | 'Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Western Slope Refining Co. | 15,200 | 16,000 | 8,100 | $^{5}$4,200 | .... | .... | $^{2}$3,400 | $^{1}$5,000 | .... | $^{1}$3,400 | .... | .... | .... | .... | $^{1}$6.0 | 200 |
| **Total** | **91,200** | **101,000** | **41,100** | **4,200** | **25,500** | **1,000** | **22,400** | **5,000** | ...... | **34,200** | **3,800** | ...... | ...... | **5,000** | **6.0** | **200** |
| **DELAWARE** | | | | | | | | | | | | | | | | |
| Star Enterprise—Delaware City | 140,000 | 150,000 | 95,000 | $^{4}$46,000 | $^{1}$65,000 | 5,000 | $^{2}$18,000<br>$^{5}$38,000 | $^{4}$19,000 | ...... | $^{1}$55,000<br>$^{4}$55,000 | $^{1}$8,000<br>*5,500 | ...... | ...... | ...... | $^{1}$40.0 | 2,180 |
| **Total** | **140,000** | **150,000** | **95,000** | **46,000** | **65,000** | **5,000** | **56,000** | **19,000** | ...... | **110,000** | **13,500** | ...... | ...... | ...... | **40.0** | **2,180** |
| **GEORGIA** | | | | | | | | | | | | | | | | |
| Amoco Oil Co.—Savannah | 28,000 | 30,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 22,500 | ...... | ...... |
| Young Refining Corp.—Douglasville | 7,500 | 8,200 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 4,000 | ...... | ...... |
| **Total** | **35,500** | **38,200** | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | **26,500** | ...... | ...... |
| **HAWAII** | | | | | | | | | | | | | | | | |
| Chevron U.S.A. Inc.—Barber's Point | 52,800 | 55,000 | 31,250 | ...... | $^{1}$20,000 | ...... | ...... | ...... | ...... | $^{3}$3,500 | $^{1}$4,500<br>†1,125 | $^{4}$1,500 | ...... | 1,300 | $^{1}$2.5 | ...... |
| Hawaiian Independent Refinery Inc.—Ewa Beach | 77,000 | 80,000 | 40,000 | $^{3}$13,000 | ...... | ...... | $^{2}$12,000 | $^{1}$16,000 | ...... | $^{2}$11,000 | ...... | ...... | ...... | 1,100 | $^{2}$17.6 | ...... |
| **Total** | **129,800** | **135,000** | **71,250** | **13,000** | **20,000** | ...... | **12,000** | **16,000** | ...... | **14,500** | **5,625** | **1,500** | ...... | **2,400** | **20.1** | ...... |
| **ILLINOIS** | | | | | | | | | | | | | | | | |
| Clark Oil & Refining Corp.—Blue Island | 64,600 | 68,000 | 27,000 | ...... | $^{1}$25,000 | 1,000 | $^{2}$30,500 | $^{1}$9,500 | ...... | $^{1}$20,500 | $^{2}$6,000 | ...... | ...... | 4,500 | ...... | ...... |
| Hartford | 60,000 | 65,000 | 18,000 | $^{5}$14,500 | $^{1}$26,000 | 1,006 | $^{2}$12,000 | ...... | ...... | $^{1}$12,000<br>$^{2}$4,000<br>$^{4}$4,000<br>$^{5}$8,000 | $^{2}$8,000 | $^{6}$4,000 | ...... | ...... | $^{1}$2.5 | 750 |
| Marathon Petroleum Co.—Robinson | 195,000 | 205,000 | 62,000 | $^{3}$4,000<br>$^{5}$22,000 | $^{1}$42,000 | .... | $^{4}$38,000<br>$^{5}$41,000 | $^{1}$23,000 | $^{5}$6,000 | $^{1}$65,000 | $^{2}$12,000 | $^{6}$11,500 | ...... | ...... | $^{1}$25.0 | 1,200 |
| Mobil Oil Corp.—Joliet | 180,000 | 200,000 | 88,000 | $^{5}$38,000 | $^{1}$98,000 | ...... | $^{2}$46,000 | ...... | ...... | $^{1}$72,000<br>$^{2}$9,000<br>$^{5}$75,000 | $^{2}$25,000 | ...... | ...... | ...... | ...... | 2,350 |
| Shell Oil Co.—Wood River | 274,000 | 286,000 | 108,000 | $^{3}$18,000 | $^{1}$94,000 | ...... | $^{2}$18,000<br>$^{3}$75,000 | $^{1}$33,500 | $^{3}$29,000 | $^{2}$64,000<br>$^{4}$79,500<br>$^{6}$10,500 | $^{1}$22,000 | $^{1}$4,500 | 4,600 | 28,500 | $^{1}$28.3 | ...... |
| Unocal Corp.—Lemont | 147,000 | 153,000 | 58,000 | $^{5}$27,900 | $^{1}$58,000 | 10,000 | $^{2}$29,800 | ...... | ...... | $^{1}$29,800<br>$^{2}$22,200<br>$^{3}$6,400<br>$^{5}$39,000<br>$^{7}$2,100<br>$^{7}$4,300 | $^{2}$18,000 | $^{1}$3,500<br>$^{6}$7,400 | ...... | 3,600 | $^{1}$11.0 | 2,000 |
| **Total** | **920,600** | **977,000** | **361,000** | **124,400** | **343,000** | **12,000** | **290,300** | **66,000** | **35,000** | **527,300** | **91,000** | **30,900** | **4,600** | **36,600** | **66.8** | **6,300** |
| **INDIANA** | | | | | | | | | | | | | | | | |
| Amoco Oil Co.—Whiting | 350,000 | 360,000 | 203,000 | $^{5}$27,500 | $^{1}$140,000 | 4,000 | $^{3}$85,000 | ...... | $^{3}$80,000 | $^{1}$87,000<br>$^{2}$24,000<br>$^{5}$42,000<br>$^{6}$4,300 | $^{1}$26,000 | $^{1}$14,000<br>$^{6}$21,000 | 6,400 | 40,000 | ...... | 1,550 |

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†Dimersol.

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Indiana Farm Bureau Cooperative Association Inc.—Mt. Vernon | 20,600 | 21,500 | 7,200 | ...... | [1]7,000 | ...... | [2]4,000 | ...... | ...... | [2]6,000 | [2]1,700 | [6]2,000 | ...... | ...... | ...... | ...... |
| Laketon Refining Corp.—Laketon | 8,300 | 10,000 | 6,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3,500 | ...... | ...... |
| Marathon Petroleum Co.—Indianapolis[1] | 48,000 | 50,000 | 17,000 | ...... | [1]19,500 | ...... | [2]10,500 | ...... | ...... | [1]13,500 | [2]6,000 | ...... | ...... | 2,500 | ...... | ...... |
| **Total** | **426,900** | **441,500** | **233,200** | **27,500** | **166,500** | **4,000** | **99,500** | ...... | **80,000** | **176,800** | **33,700** | **37,000** | **6,400** | **46,000** | ...... | **1,550** |

Solvent extraction: [1]5,000.

## KANSAS

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Refining & Marketing Inc.—Augusta | ...... | ...... | ...... | ...... | ...... | ...... | [4]10,000 | ...... | ...... | [1]14,500 | ...... | [6]6,500 | ...... | ...... | ...... | ...... |
| Derby Refining Co.—El Dorado[1] | *30,400 | 32,000 | 12,000 | ...... | [1]14,500 | ...... | [2]4,500 | ...... | ...... | [4]4,000 | [2]2,800 | ...... | ...... | 2,500 | ...... | ...... |
| Wichita | *29,925 | 31,500 | 10,000 | [5]5,500 | [1]19,000 | ...... | [2]6,500 | ...... | ...... | [1]7,000 | [2]2,800<br>*3,500 | ...... | ...... | ...... | ...... | 210 |
| Farmland Industries Inc.—Coffeyville | 56,500 | 60,723 | 19,500 | [5]12,000 | [1]23,000 | 1,500 | [2]16,000 | ...... | ...... | [1]26,500 | [2]6,000 | [6]8,000 | ...... | ...... | ...... | 600 |
| Phillipsburg | 26,400 | 27,460 | 10,000 | ...... | ...... | ...... | [2]5,300 | ...... | ...... | [1]7,500 | ...... | ...... | ...... | 2,000 | ...... | ...... |
| National Cooperative Refinery Association—McPherson | 70,900 | 75,000 | 27,000 | [5]22,000 | [1]20,000 | 1,000 | [4]15,000 | ...... | ...... | [1]10,000<br>[2]14,500<br>[4]13,000 | [2]6,000 | [4]2,000<br>[6]9,500 | ...... | ...... | ...... | 650 |
| Texaco Refining & Marketing Inc.—El Dorado | 78,000 | 83,000 | 32,000 | [5]12,500 | [1]31,500 | 2,500 | [2]18,500 | ...... | [3]44,000 | [1]20,000<br>[2]20,000<br>[4]9,000 | [2]12,500 | [6]15,000 | ...... | ...... | ...... | 610 |
| Total Petroleum Inc.—Arkansas City | 56,000 | 59,000 | 16,150 | ..... | [1]19,500 | ...... | [2]18,000 | [4]3,190 | ...... | [1]18,000 | [2]5,500 | ...... | ...... | ...... | ...... | ...... |
| **Total** | **348,125** | **368,683** | **126,650** | **52,000** | **127,500** | **5,000** | **93,800** | **3,190** | **44,000** | **164,000** | **39,100** | **41,000** | ..... | **4,500** | ...... | **2,070** |

Solvent extraction: [1]5,000 b/sd.

## KENTUCKY

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashland Petroleum Co.—Catlettsburg | 213,400 | 220,000 | 92,000 | [2]2,600<br>†[6]55,000 | [1]60,000<br>§[2]40,000 | ...... | [2]25,000<br>[5]27,000 | ...... | [3]40,000 | [1]60,000<br>[2]6,000<br>[3]6,000<br>[4]40,000<br>∫[7]29,000 | [2]12,000<br>*1,000 | [1]5,400<br>[6]12,000 | 8,500 | 30,000 | .... | ...... |
| Somerset Refinery Inc.—Somerset | 5,500 | 6,300 | ...... | ...... | ...... | ...... | [2]1,000 | [1]400 | ...... | [1]1,300<br>[5]400 | ...... | [6]200 | ...... | ...... | ...... | ...... |
| **Total** | **218,900** | **226,300** | **92,000** | **57,600** | **100,000** | ...... | **53,000** | **400** | **40,000** | **142,700** | **13,000** | **17,600** | **8,500** | **30,000** | ..... | ...... |

†ART. §Reduced crude converter. ∫Aromatics 5,000. C3/C4 12,000. C5/C6 12,000.

## LOUISIANA

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlas Processing Co., Division of Pennzoil—Shreveport | 46,200 | 50,000 | 24,300 | ...... | ...... | ...... | [2]10,000 | ...... | ...... | [1]10,000<br>[6]3,400<br>[7]6,700 | ...... | ...... | 8,500 | 600 | [1]6.1 | ...... |
| Calcasieu Refining Co.—Lake Charles | 12,000 | 13,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Calumet Refining Co.—Princeton | 4,500 | 4,500 | 4,500 | ...... | ...... | ...... | ...... | ...... | ...... | [6]4,500 | ...... | ...... | 4,500 | 900 | [1]4.5 | ...... |
| Canal Refining Co.—Church Point | 9,865 | 10,000 | ...... | ...... | ...... | ...... | [1]1,900 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Citgo Petroleum Corp.—Lake Charles | 320,000 | 330,000 | 83,000 | [5]63,000 | [1]150,000 | ...... | [2]46,000<br>[5]45,000 | [1]37,000 | [3]40,000 | [1]91,000<br>[4]14,000 | [1]20,200 | ...... | 9,000 | ...... | ...... | 3,000 |

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | — Cat cracking — | | | | | | | | | | | |
| | b/cd | b/sd | Vacuum distillation | Thermal operations | Fresh feed | Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Conoco Inc.—Lake Charles | 159,500 | 167,000 | 63,000 | [2]12,000<br>[5]60,000 | [1]42,500 | ...... | [2]16,000<br>[5]12,000 | ...... | ...... | [1]32,000<br>[5]109,000<br>[7]13,000 | [1]7,500<br>*2,100 | ...... | ...... | ...... | ...... | 3,650 |
| Exxon Co.—Baton Rouge[1] | 421,000 | 438,000 | 183,000 | [5]90,000 | [1]188,000 | ...... | [4]90,000 | [1]24,000 | ...... | [1]95,000<br>[3]2,500<br>[5]55,000<br>[6]17,000<br>†[7]45,000 | [1]33,200<br>*8,000 | [5]12,500 | 16,500 | 28,900 | ...... | 4,980 |
| Hill Petroleum Co.—Krotz Springs | 62,300 | 65,000 | 24,000 | ...... | [1]30,000 | ...... | [2]12,500 | ...... | ...... | [1]12,500 | *6,600 | ...... | ...... | ...... | ...... | ...... |
| St. Rose | 40,000 | 41,000 | 20,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Kerr-McGee Refining Corp.—Cotton Valley | 7,800 | 8,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Marathon Petroleum Co.—Garyville[4] | 255,000 | 263,000 | 125,000 | ...... | [1]90,000 | ...... | [5]48,000 | ...... | [2]71,000<br>[4]38,000 | [1]48,000<br>[7]19,000 | [2]26,000 | [4]18,500<br>[6]19,000 | ...... | 25,000 | ...... | ...... |
| Mobil Oil Corp.—Chalmette | 160,000 | 170,000 | 92,500 | [5]33,000 | [1]55,000 | ...... | [2]28,000<br>[4]19,000 | [1]18,000 | [3]43,000 | [1]45,000<br>[5]24,000 | [2]19,000 | [1]7,000 | ...... | ...... | [1]24.0 | 1,550 |
| Murphy Oil USA Inc.—Meraux[2] | 92,500 | 95,400 | 40,000 | ...... | [1]35,000 | 2,500 | [6]23,000 | ...... | [4]15,000 | [1]29,000 | [1]8,700 | ...... | ...... | ...... | ...... | ...... |
| Placid Refining Co.—Port Allen[3] | 47,000 | 50,000 | 18,000 | ...... | [1]19,000 | 1,500 | [2]10,000 | ...... | ...... | [1]10,000 | [2]3,700 | ...... | ...... | ...... | ...... | ...... |
| Shell Oil Co.—Norco | 215,000 | 220,000 | 78,000 | [1]89,000<br>[5]21,000<br>[6]17,700 | ...... | ...... | [2]18,000<br>[3-4]38,000 | [1]35,000 | [3]70,000 | [2]29,000<br>[3]28,000 | [1]15,000<br>*9,400 | ...... | ...... | ...... | [1]70.0 | 1,000 |
| Sohio Oil Co.(BP America)—Belle Chasse | *194,750 | 205,000 | 73,000 | [5]21,000 | [1]89,000 | 2,300 | [2]37,500 | ...... | ...... | [2]42,000<br>[4]24,000<br>[5]22,000 | [2]28,400 | [1]24,000<br>[2]6,300 | ...... | ...... | ...... | 845 |
| Star Enterprise—Convent | 225,000 | 240,000 | 75,000 | [3]12,000 | [1]85,000 | 5,000 | [2]40,000 | [2]35,000 | ...... | [1]40,000<br>[4]37,000<br>[5]65,000 | [1]14,500<br>*4,000 | [6]12,500 | ...... | ...... | [3]63.0 | ...... |
| **Total** | **2,272,415** | **2,370,900** | **903,300** | **418,700** | **783,500** | **11,300** | **494,900** | **149,000** | **277,000** | **972,600** | **206,300** | **99,800** | **38,500** | **55,400** | **167.6** | **15,025** |

Solvent extraction: [1]6,900 b/sd. [2]12,000 b/sd. [3]6,000 b/sd. [4]30,000 b/sd.
† Wax 2,000. Alky feed 43,000.

## MICHIGAN

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crystal Refining Co.—Carson City | 4,000 | 6,200 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Lakeside Refining Co.—Kalamazoo | 5,600 | *5,895 | ...... | ...... | ...... | ...... | [1]1,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Marathon Petroleum Co.—Detroit[1] | 68,500 | 71,000 | 30,000 | ...... | [1]27,000 | 1,300 | [2]18,500 | ...... | [3]14,000<br>[4]2,000 | [1]21,000 | [1]4,000 | ...... | ...... | 10,000 | ...... | ...... |
| Total Petroleum Inc.—Alma | 45,600 | 51,000 | ...... | ...... | [1]19,500 | ...... | [2]14,000 | ...... | [2]3,800<br>[4]2,000 | [1]21,000<br>[4]2,000 | [2]5,000<br>*1,000 | [6]7,000 | ...... | ...... | ...... | ...... |
| **Total** | **123,700** | **134,095** | **30,000** | ...... | **46,500** | **1,300** | **33,500** | ...... | **21,800** | **44,000** | **10,000** | **7,000** | ...... | **10,000** | ...... | ...... |

[1]Etherification MTBE 1,100.

## MINNESOTA

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashland Petroleum Co.—St. Paul Park | 67,100 | 69,220 | 32,000 | ...... | [1]23,000 | ...... | [2]23,500 | ...... | [3]23,000 | [1]24,500<br>[4]7,200<br>[7]8,300 | [2]5,500<br>*350 | [6]8,300 | ...... | 14,000 | ...... | ...... |
| Koch Refining Co.—Rosemount | *218,500 | 230,000 | 160,000 | [5]58,000 | [1]55,000 | 1,000 | [6]26,000<br>[2]6,000 | ...... | [3]63,500 | [1]26,000<br>[2]15,000<br>[4]46,000 | [1]8,500<br>*1,100<br>†3,700 | [6]15,000 | ...... | 35,000 | [1]20.0 | 2,800 |
| **Total** | **285,600** | **299,220** | **192,000** | **58,000** | **78,000** | **1,000** | **55,500** | ...... | **86,500** | **127,000** | **19,150** | **23,300** | ...... | **49,000** | **20.0** | **2,800** |

†Dimersol.

## MISSISSIPPI

| Company and location | Crude capacity b/cd | b/sd | Charge capacity, b/sd: Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/sd: Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amerada-Hess Corp.—Purvis | 30,000 | *31,579 | 20,000 | [4]8,000 | [2]16,000 | ...... | [2]5,800 | ...... | ...... | [2]5,800<br>[4]6,000 | [1]3,500 | ...... | ...... | ...... | ...... | 250 |
| Chevron U.S.A. Inc.—Pascagoula | 295,000 | 310,000 | 243,000 | [5]62,000 | [1]58,000 | ...... | [2]90,000 | [1]68,000 | [1]96,000<br>[3]63,000<br>[4]30,000<br>[5]5,000 | [1]48,000 | [1]16,200 | [1]5,500 | ...... | 20,000 | [1]215.0 | 3,200 |
| Ergon Refining Inc.—Vicksburg | 16,800 | 18,300 | 15,600 | ...... | ...... | ...... | ...... | ...... |  | ...... | ...... | ...... | 5,000 | 12,000 | [1]2.5 | ...... |
| Southland Oil Co.—Lumberton | 5,800 | 6,500 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3,500 | ...... | ...... |
| Sandersville | 11,000 | 12,500 | .... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 5,100 | ...... | ...... |
| **Total** | **358,600** | **378,879** | **278,600** | **70,000** | **74,000** | ...... | **95,800** | **68,000** | **194,000** | **59,800** | **19,700** | **5,500** | **5,000** | **40,600** | **217.5** | **3,450** |

## MONTANA

| Company and location | Crude capacity b/cd | b/sd | Charge capacity, b/sd: Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/sd: Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cenex—Laurel[1] | 40,400 | 42,500 | 14,000 | ...... | [1]12,000 | 3,000 | [2]12,000 | ...... | [4]14,000 | [1]15,000 | [2]3,000 | [4]2,000 | ...... | 6,000 | ...... | ...... |
| Conoco Inc.—Billings[2] | 49,500 | 52,000 | 20,000 | ...... | [1]18,500 | 1,000 | [2]14,700 | ...... | ...... | [4]38,000<br>[5]4,500 | [2]6,000 | [4]3,800 | ...... | 6,500 | ...... | ...... |
| Exxon Co.—Billings | 42,000 | 44,000 | 18,000 | [4]7,700 | [1]21,000 | 3,500 | [1]10,000 | [1]4,900 | ...... | [2]15,500<br>[4]10,000<br>[5]10,000<br>[7]6,000 | [2]3,400 | ...... | ...... | 11,000 | [5]19.3 | 435 |
| Montana Refining Co.—Great Falls | 7,000 | 7,200 | 2,800 | ...... | [1]2,400 | 200 | [2]1,000 | ...... | ...... | [1]1,200<br>[4]1,300 | *300 | [6]650 | ...... | 1,200 | ...... | ...... |
| **Total** | **138,900** | **145,700** | **54,800** | **7,700** | **53,900** | **7,700** | **37,700** | **4,900** | **14,000** | **101,500** | **12,700** | **6,450** | ...... | **24,700** | **19.3** | **435** |

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Solvent extraction: [1]4,000 b/sd. [2]7,500 b/sd (PDA).

## NEVADA

| Company and location | Crude capacity b/cd | b/sd | Charge capacity, b/sd: Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/sd: Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nevada Refining Co.—Tonopah | **4,500** | **4,700** | **2,500** | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |

## NEW JERSEY

| Company and location | Crude capacity b/cd | b/sd | Charge capacity, b/sd: Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/sd: Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amerada-Hess Corp.—Port Reading | ...... | ...... | ...... | ...... | [1]50,000 | ...... | ...... | ...... | ...... | ...... | [1]4,500<br>*5,000 | ...... | ...... | ...... | ...... | ...... |
| Chevron U.S.A. Inc.—Perth Amboy | 80,000 | 85,000 | 46,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 35,000 | ...... | ...... |
| Coastal Eagle Point Oil Co.—Westville | *109,250 | 115,000 | 45,000 | [3]10,000 | [1]50,000 | ...... | [2]27,000 | ...... | ...... | [1]25,000<br>[4]14,000<br>[5]17,000<br>[7]4,800 | [1]4,000<br>*2,500 | †2,000 | ...... | ...... | ...... | ...... |
| Exxon Co.—Linden | 130,000 | 135,000 | 66,000 | ...... | [1]120,000 | 25,000 | [4]28,000 | ...... | [2]50,000 | [1]29,000<br>[2]19,000<br>[5]65,000 | [1]10,500 | [6]25,000 | ...... | 38,000 | ...... | ...... |
| Mobil Oil Corp.—Paulsboro[1] | 100,000 | 104,000 | 62,400 | [5]21,500 | [1]36,000 | ...... | [2]23,500 | ...... | [5]15,000 | [1]23,500<br>[5]42,000<br>[6]300 | [2]5,000 | ...... | 8,500 | ...... | [1]11.0 | 1,010 |
| Seaview Petroleum Co. L.P.—Thorofare | 75,000 | *75,947 | 30,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| **Total** | **494,250** | **517,947** | **249,400** | **31,500** | **256,000** | **25,000** | **78,500** | ...... | **65,000** | **239,600** | **31,500** | **27,000** | **8,500** | **73,000** | **11.0** | **1,010** |

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Solvent extraction: [1]9,500 b/sd. †Cumene.
* Distillation

## NEW MEXICO

| Company and location | Crude capacity b/cd | b/sd | Charge capacity, b/sd: Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/sd: Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bloomfield Refining Co.—Bloomfield | 16,800 | 18,107 | ...... | ...... | [1]6,000 | 500 | [2]4,000 | ...... | ...... | [1]4,000 | *2,000 | ...... | ...... | ...... | ...... | ...... |
| Giant Industries Inc.—Gallup | 19,000 | 20,000 | 7,900 | ...... | [1]7,200 | 3,600 | [2]6,800 | ...... | ...... | [2]6,800 | [2]1,400 | [6]4,000 | ...... | 700 | ...... | ...... |

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. $^{*}$Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Navajo Refining Co.—Artesia | $^{*}$38,000 | 40,000 | 6,000 | ...... | $^{1}$14,500 | 2,500 | $^{2}$7,800 | ...... | ...... | $^{1}$10,000<br>$^{4}$6,500<br>$^{5}$3,000 | $^{2}$2,000 | ...... | ...... | 3,400 | ...... | ...... |
| Thriftway Marketing Corp.—Farmington | 6,500 | $^{*}$6,825 | ...... | $^{2}$1,000 | ...... | ...... | $^{2}$2,500 | $^{2}$1,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| **Total** | **80,300** | **84,932** | **13,900** | **1,000** | **27,700** | **6,600** | **21,100** | **1,000** | ...... | **30,300** | **5,400** | **4,000** | ...... | **4,100** | ...... | ...... |
| **NEW YORK** | | | | | | | | | | | | | | | | |
| Cibro Petroleum Products Co.—Albany | $^{*}$**42,500** | **45,000** | **27,000** | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | .... | ...... | ...... |
| **NORTH DAKOTA** | | | | | | | | | | | | | | | | |
| Amoco Oil Co.—Mandan | 58,000 | 60,000 | ...... | ...... | $^{1}$26,000 | 5,200 | $^{4}$12,100 | ...... | ...... | $^{2}$16,600 | $^{2}$3,400<br>$^{*}$1,200 | $^{6}$4,000 | ...... | ...... | ...... | ...... |
| **Total** | **58,000** | **60,000** | ...... | ...... | **26,000** | **5,200** | **12,100** | ...... | ...... | **16,600** | **4,600** | **4,000** | ...... | ...... | ...... | ...... |
| **OHIO** | | | | | | | | | | | | | | | | |
| Ashland Petroleum Co.—Canton | 66,000 | 68,000 | 33,000 | ...... | $^{1}$25,000 | ...... | $^{5}$20,000 | ...... | $^{3}$23,000 | $^{1}$20,000<br>$^{4}$7,000<br>$^{7}$6,500 | $^{2}$7,000<br>$^{*}$500 | $^{6}$6,500 | ...... | 12,000 | ...... | ...... |
| Sohio Oil Co. (BP America)—Lima | $^{*}$171,000 | 180,000 | 51,000 | $^{5}$16,200 | $^{1}$36,000 | 7,800 | $^{4}$53,000 | $^{4}$23,000 | ...... | $^{1}$59,000 | ...... | $^{1}$24,400<br>$^{2}$6,500<br>$^{6}$16,600 | 2,100 | ...... | ...... | 620 |
| Toledo | $^{*}$120,650 | 127,000 | 49,000 | $^{5}$13,700 | $^{1}$55,000 | ...... | $^{3}$23,000<br>$^{4}$19,000 | $^{4}$35,000 | ...... | $^{1}$37,000 | $^{1}$11,300 | ...... | ...... | 7,000 | $^{1}$24.0 | 630 |
| Sun Refining & Maketing Co.—Toledo$^{1}$ | 125,000 | 133,000 | 30,000 | ...... | $^{1}$60,000 | 1,000 | $^{2}$45,600 | $^{1}$28,200 | ...... | $^{1}$40,000 | $^{1}$7,800<br>$^{*}$2,800 | $^{1}$9,000<br>$^{2}$2,400 | ...... | ...... | $^{1}$41.0 | ...... |
| **Total** | **482,650** | **508,000** | **163,000** | **29,900** | **176,000** | **8,800** | **160,600** | **86,200** | **23,000** | **169,500** | **29,400** | **65,400** | **2,100** | **19,000** | **65.0** | **1,250** |
| Solvent extraction: $^{1}$9,000 b/sd. | | | | | | | | | | | | | | | | |
| **OKLAHOMA** | | | | | | | | | | | | | | | | |
| Barrett Refining Corp.—Thomas | 13,000 | $^{*}$13,684 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Conoco Inc.—Ponca City | 140,000 | 145,000 | 45,000 | $^{5}$20,500 | $^{1}$53,000 | ...... | $^{2}$36,000 | ...... | ...... | $^{1}$36,000<br>$^{5}$30,000 | $^{2}$12,000<br>$^{*}$2,100 | $^{4}$4,500 | 2,000 | ...... | ...... | 960 |
| Kerr-McGee Refining Corp.—Wynnewood$^{1}$ | 43,000 | 45,000 | 13,000 | ...... | $^{1}$20,000 | ...... | $^{2}$8,500 | $^{1}$5,000 | ...... | $^{1}$9,000 | $^{2}$5,000 | $^{6}$4,000 | ...... | ...... | $^{1}$10.0 | ...... |
| Sinclair Oil Corp.—Tulsa | 50,000 | $^{*}$52,632 | 26,500 | ...... | $^{1}$18,000 | 5,000 | $^{2}$12,000 | ...... | ...... | $^{1}$12,000<br>$^{5}$5,000 | $^{1}$3,000 | $^{4}$500<br>$^{6}$6,000 | ...... | 2,500 | ...... | ...... |
| Sun Refining & Marketing Co.—Tulsa$^{2}$ | 85,000 | 90,000 | 29,000 | ...... | $^{1}$30,000 | 840 | $^{2}$24,000 | ...... | ...... | $^{1}$24,000<br>$^{6}$10,500 | $^{2}$7,000 | $^{1}$2,200<br>$^{2}$1,200<br>$^{3}$2,000<br>$^{4}$3,000 | 8,000 | 4,600 | ...... | 300 |
| Total Petroleum Inc.—Ardmore | 60,500 | 63,000 | 32,000 | ...... | $^{1}$23,500 | ...... | $^{6}$14,000 | ...... | $^{2}$21,000 | $^{1}$20,000 | $^{2}$7,000 | $^{6}$6,000 | ...... | 6,000 | ...... | ...... |
| **Total** | **391,500** | **409,316** | **145,500** | **20,500** | **144,500** | **5,840** | **94,500** | **5,000** | **21,000** | **146,500** | **36,100** | **29,400** | **10,000** | **13,100** | **10.0** | **1,260** |
| Solvent extraction: $^{1}$5,000 b/sd. $^{2}$10,000 b/sd. | | | | | | | | | | | | | | | | |
| **OREGON** | | | | | | | | | | | | | | | | |
| Chevron U.S.A. Inc.—Portland | **15,000** | **15,789** | **16,000** | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | **11,500** | ...... | ...... |

| Company and location | Crude capacity |  | Charge capacity, b/sd |  |  |  |  |  |  |  | Production capacity, b/sd |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | b/cd | b/sd | Vacuum distillation | Thermal operations | Cat cracking — Fresh feed | Cat cracking — Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| **PENNSYLVANIA** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Atlantic Refining & Marketing Corp.—Philadelphia | 125,000 | 130,000 | 83,000 | ...... | [1]29,000 | ...... | [2]60,000 | [4]30,000 | ...... | [1]54,000<br>[4]50,000<br>[7]24,000 | ...... | ...... | ...... | 35,000 | [5]40.0 | ...... |
| Chevron U.S.A. Inc.—Philadelphia | 175,000 | 180,000 | 80,000 | ...... | [1]53,300 | 5,000 | [2]34,000 | ...... | ...... | [2]34,000<br>[4]30,000 | [2]18,000 | [1]4,000<br>[2]1,300 | ...... | ...... | ...... | ...... |
| Pennzoil Products Co.—Rouseville | 15,700 | 16,500 | 6,500 | ...... | ...... | ...... | [2]5,820 | ...... | ...... | [1]6,500<br>[6]7,800 | ...... | [6]1,150 | 4,750 | ...... | [1]3.5 | ...... |
| Quaker State Oil Refining Corp.—Smethport[1] | 6,500 | 7,000 | 2,680 | ...... | ...... | ...... | [2]2,100 | ...... | ...... | [1]2,900 | ...... | [6]800 | 2,560 | ...... | ...... | ...... |
| Sohio Oil Co. (BP America)—Marcus Hook | *171,000 | 180,000 | 75,000 | ...... | [1]50,000 | 1,600 | [6]48,000 | [4]21,000 | [3]50,000 | [1]64,000<br>[4]22,000<br>[5]22,000 | [2]12,000 | ...... | ...... | ...... | ...... | ...... |
| Sun Refining & Marketing Co.—Marcus Hook | 165,000 | 185,000 | 46,000 | ...... | [1]87,000 | ...... | [2]39,600 | ...... | ...... | [1]54,300<br>[4]14,400<br>[5]13,000<br>[6]6,000 | [1]12,000 | [1]7,000 | 10,000 | ...... | [1]6.0 | ...... |
| Philadelphia | 125,000 | 130,000 | 83,000 | ...... | [1]29,000 | ...... | [2]50,000 | [4]30,000 | ...... | [1]54,000<br>[4]50,000<br>[7]24,000 | ...... | ...... | ...... | 35,000 | [5]40.0 | ...... |
| United Refining Co.—Warren | *64,600 | 68,000 | 27,000 | ...... | [1]20,000 | 200 | [2]16,000 | ...... | ...... | [1]20,000<br>[4]6,000 | [1]3,000<br>*2,000 | [6]6,800 | ...... | 8,000 | ...... | ...... |
| Witco Chemical Co.—Bradford | 8,200 | 11,500 | ...... | ...... | ...... | ...... | [2]3,300 | ...... | ...... | ...... | ...... | ...... | 4,000 | ...... | ...... | ...... |
| **Total** | **856,000** | **906,000** | **403,180** | ...... | **268,300** | **6,800** | **258,820** | **81,000** | **50,000** | **558,900** | **47,000** | **21,050** | **21,310** | **78,000** | **89.5** | ...... |

Solvent extraction: [1]730 b/sd

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking — Fresh feed | Cat cracking — Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TENNESSEE** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mapco Petroleum Inc.—Memphis | 60,000 | 62,000 | 12,000 | ...... | [1]30,000 | ...... | [2]10,000 | ...... | ...... | [1]10,000<br>[2]5,000<br>[5]16,000 | [2]3,000<br>*2,500 | [6]4,000 | ...... | 3,500 | ...... | ...... |
| **Total** | **60,000** | **62,000** | **12,000** | ...... | **30,000** | ...... | **10,000** | ...... | ...... | **31,000** | **5,500** | **4,000** | ...... | **3,500** | ...... | ...... |

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking — Fresh feed | Cat cracking — Recycle | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TEXAS** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Amoco Oil Co.—Texas City | 415,000 | 460,000 | 195,000 | [5]37,000 | [1]195,000 | 43,000 | [4]160,000 | [1]60,000<br>[2]60,000 | [3]85,000 | [1]140,000<br>[4]35,000<br>[5]35,000<br>[7]28,000 | [1]22,000<br>[2]32,000 | [1]45,000<br>[6]28,000 | ...... | ...... | [1]180.0 | 1,900 |
| Champlin Refining Co.—Corpus Christi | 135,000 | 140,000 | 80,000 | [5]32,000 | [1]70,000 | ...... | [5]52,000 | ...... | [2]55,000<br>[4]40,000 | [2]54,000 | [2]19,000 | [1]5,000<br>[3]2,500 | ...... | ...... | ...... | 1,800 |
| Chevron U.S.A. Inc.—El Paso | 66,000 | 68,000 | 54,000 | ...... | [1]22,000 | ...... | [2]25,000 | ...... | [4]19,000 | [1]25,000 | [1]5,500 | [4]3,000 | ...... | 5,500 | ...... | ...... |
| Port Arthur | 329,000 | 338,000 | 163,200 | [5]34,000 | [1]110,000 | 6,000 | [2]23,000<br>[4]44,100 | ...... | ...... | [2]67,100<br>[4]138,000<br>[6]13,900 | [2]16,900 | [1]7,095<br>[2]2,905<br>[3]2,500<br>[5]7,200 | 10,000 | ...... | ...... | 1,840 |
| Coastal Refining & Marketing Inc.—Corpus Christi | *90,250 | 95,000 | 53,000 | [3]11,000<br>[5]12,000 | [1]18,500 | ...... | [2]11,000<br>[6]17,500 | [1]10,000 | ...... | [1]30,000<br>[4]20,000<br>[6]25,000 | [2]3,200<br>*3,000 | [1]11,000<br>[2]7,000<br>[6]5,300 | ...... | .... | [1]24.0<br>[4]15.0 | 650 |
| Crown Central Petroleum Corp.—Houston | 100,000 | 105,000 | 40,000 | [5]12,500 | [1]56,000 | ...... | [2]14,000<br>[5]22,000 | ...... | [4]10,000 | [1]26,000 | [2]13,000 | [1]2,000<br>[2]2,000<br>[6]5,000 | ...... | ...... | ...... | 350 |

|  |  |  | Charge capacity, b/sd |  |  |  |  |  |  |  | Production capacity, b/sd |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Diamond Shamrock Corp.—Sunray[1] | 110,000 | 115,000 | 47,000 | ...... | [1]45,000 | ...... | [2]29,000 | [4]20,000 | ...... | [1]33,000 | [1]8,700<br>*4,600 | ...... | ...... | 5,000 | ...... | ...... |
| Three Rivers[2] | 50,000 | 52,000 | 20,000 | ...... | [1]20,000 | ...... | [2]11,000 | ...... | ...... | [1]11,000 | [2]6,000 | ...... | 1,000 | ...... | ...... | ...... |
| El Paso Refining Co. Ltd.—El Paso | 26,000 | 27,500 | ...... | [5]4,400 | [1]10,800 | .... | [2]6,700 | ...... | ...... | [1]6,700 | [1]3,000 | [4]700 | ...... | ...... | ...... | 120 |
| Exxon Co. U.S.A.—Baytown[3] | 426,000 | 448,000 | 219,000 | [4]28,000 | [1]170,000 | 15,000 | [3]60,000<br>[4]63,000 | [1]19,000 | [2]110,000 | [1]139,000<br>[3]23,500<br>[4]108,000<br>[5]80,000<br>[6]44,100 | [1]29,000 | ...... | 31,200 | 7,000 | [1]85.0 | 100 |
| Fina Oil & Chemical Co.—Big Spring[4] | 55,000 | 60,000 | 24,000 | ...... | [1]22,000 | ...... | [2]20,000 | ...... | [2]6,000 | [1]25,000<br>[4]3,000<br>[5]15,000 | [2]5,000 | [1]1000 | ...... | 7,000 | ...... | ...... |
| Port Arthur[5] | 110,000 | 115,000 | 50,000 | ...... | [1]36,000 | ...... | [5]34,000 | ...... | [2]18,000<br>[3]13,000 | [1]40,000<br>[5]28,000 | [1]5,500 | [1]10,000<br>[6]8,500 | ...... | 2,000 | ...... | ...... |
| Hill Petroleum Co.—Houston[6] | 66,000 | 70,000 | 28,000 | ...... | [1]50,000 | ...... | [2]13,500 | ...... | ...... | [1]14,000<br>[4]23,000<br>[7]7,000 | [1]4,000 | [1]2,000 | ...... | 5,000 | ...... | ...... |
| Texas City | 123,000 | 130,000 | 64,000 | [3]21,000 | [1]50,000 | ...... | [2]11,000<br>[6]12,000 | ...... | .... | [1]23,000<br>[4]29,000 | [2]6,000 | ...... | ...... | ...... | ...... | ...... |
| Howell Hydrocarbons Inc.—San Antonio | 2,900 | 2,900 | ...... | ...... | ...... | ...... | [1]1,200 | ...... | ...... | ...... | ...... | [1]1,000 | ...... | ...... | ...... | ...... |
| Koch Refining Co.—Corpus Christi | 125,000 | 130,000 | 42,000 | [5]12,000 | [1]40,000 | 800 | [3]15,000<br>[6]33,500 | ...... | ...... | [1]49,500<br>[5]8,000 | [2]8,400 | [1]7,600<br>[2]3,200 | ...... | ...... | ...... | 375 |
| LaGloria Oil & Gas Co.—Tyler | 49,500 | 53,000 | 16,000 | [5]6,000 | [1]17,000 | 850 | [2]4,500<br>[5]11,700 | ...... | ...... | [2]20,800 | [1]4,800 | [6]5,000 | ...... | ...... | ...... | 250 |
| Liquid Energy Corp.—Bridgeport | 10,000 | 10,800 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Lyondell Petrochemical Co.—Houston[7] | 265,000 | 286,000 | 129,000 | [5]40,000 | [1]90,000 | ...... | [2]110,000 | ...... | [3]48,000<br>[4]46,000<br>[5]35,000 | [1]110,000<br>[3]10,000<br>[4]43,000<br>[7]7,000 | [1]14,000 | [1]11,000 | 6,000 | ...... | ...... | 2,650 |
| Marathon Petroleum Co.—Texas City | 69,500 | 72,000 | 27,000 | ...... | [1]38,000 | 1,000 | [1]10,000 | ...... | ...... | ...... | [2]11,000 | [1]2,500 | ...... | ...... | ...... | ...... |
| Mobil Oil Corp.—Beaumont | 275,000 | 290,000 | 86,000 | [5]29,500 | [1]102,000 | ...... | [2]57,000<br>[5]46,000 | [1]32,000 | ...... | [1]92,000<br>[5]116,000<br>[6]3,500<br>[7]2,150 | [1]13,000 | [5]20,000 | 9,400 | ...... | [1]60.0 | 1,471 |
| Phillips 66 Co.—Borger | 105,000 | 110,000 | ...... | ...... | [1]60,000 | 10,400 | [2]26,000 | ...... | [1]50,000<br>[4]40,000 | [2]26,500 | [2]14,000 | [3]3,060<br>[4]11,000<br>[5]12,100<br>[6]12,500 | ...... | ...... | [1]50.0 | ...... |
| Sweeny | 175,000 | 195,000 | 83,000 | ...... | [1]87,000 | 12,000 | [2]36,000 | ...... | [1]75,000<br>[4]50,000 | [2]53,000 | [2]15,000 | [1]5,575<br>[3]7,630<br>[5]9,100<br>[6]7,800 | ...... | ...... | [4]80.0 | ...... |
| Pride Refining Inc.—Abilene | 44,100 | 45,000 | 12,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Shell Oil Co.—Deer Park | 215,900 | 227,000 | 88,000 | [1]55,000<br>[2]19,000 | [1]65,000 | 5,000 | [2]20,000<br>[3]43,000 | [1]65,000 | [3]45,000 | [1]65,000<br>[3]37,500<br>[4]70,000<br>[6]10,000<br>[7]7,000 | [1]8,100 | [1]20,000 | 12,500 | 7,400 | [1]65.0 | ...... |
| Odessa | 28,600 | 29,500 | 10,000 | ...... | [1]10,500 | ...... | [2]10,000 | ...... | ...... | [1]11,000 | [2]3,300 | [1]350 | ...... | ...... | ...... | ...... |
| Southwestern Refining—Corpus Christi | 104,000 | 108,000 | 36,000 | ...... | [1]50,000 | ...... | [2]30,000 | ...... | [2]18,000 | [1]40,000<br>[4]27,000 | [2]7,000<br>*4,200 | [1]6,500 | ...... | ...... | ...... | ...... |
| Star Enterprise—Port Arthur | 250,000 | 278,000 | 143,100 | ...... | [1]110,000 | 31,500 | [5]42,000 | [1]15,000 | ...... | [1]42,000<br>[4]80,000<br>[6]18,500 | [1]9,000 | ...... | 17,400 | 14,000 | ...... | ...... |
| Trifinery—Corpus Christi | 27,000 | 29,800 | 15,000 | [3]10,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ..... | ...... | ...... |
| Unocal Corp.—(Beaumont), Nederland | 120,000 | 126,300 | 43,000 | ...... | [1]39,000 | 4,000 | [1]12,000<br>[2]20,000 | ...... | ...... | [1]43,000<br>[3]10,600 | [1]4,200<br>*1,400 | [1]6,000<br>[3]1,200 | 3,100 | 2,500 | ...... | ...... |

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Valero Refining Co.—Corpus Christi | 25,000 | 27,000 | 24,000 | ...... | †$^{2}$65,000 | 2,700 | ...... | ...... | $^{1}$61,000 | ...... | $^{2}$9,500<br>∫2,200 | ...... | ...... | ...... | $^{1}$64.0 | ...... |
| **Total** | **3,992,750** | **4,243,800** | **1,791,300** | **363,400** | **1,648,800** | **132,250** | **1,156,700** | **281,000** | **824,000** | **2,292,350** | **315,500** | **310,815** | **90,600** | **55,400** | **623.0** | **11,506** |

Solvent extraction: $^{1}$15,000 b/sd. $^{2}$7,000 b/sd. $^{3}$53,000 b/sd. $^{4}$10,000 b/sd. $^{5}$18,000 b/sd. $^{6}$11,000 b/sd. $^{7}$6,000 b/sd.
†Heavy oil cracker. §Dimersol. ∫ MTBE.

## UTAH

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Oil Co.—Salt Lake City | 40,000 | 41,500 | ...... | ...... | $^{1}$18,000 | 4,000 | $^{4}$7,600 | ...... | ...... | $^{1}$7,600 | $^{1}$4,000 | $^{4}$3,000 | ...... | ...... | ...... | ...... |
| Big West Oil Co.—Salt Lake City | 24,000 | 25,000 | 3,800 | ...... | $^{2}$5,000 | 1,000 | $^{2}$5,000 | ...... | ...... | $^{2}$6,000 | $^{2}$1,300 | $^{6}$1,700 | ...... | ...... | ...... | ...... |
| Chevron U.S.A.—Salt Lake City | 45,000 | 46,000 | 35,500 | $^{5}$8,500 | $^{1}$11,000<br>$^{2}$7,000 | 1,000 | $^{2}$7,500 | ...... | $^{5}$5,500 | $^{1}$7,500 | $^{2}$4,300 | $^{4}$750 | ...... | ...... | ...... | 350 |
| Crysen Refining Inc.—Woods Cross | 12,500 | 13,400 | 4,000 | ...... | ...... | ...... | $^{2}$3,000 | ...... | ...... | .... | ...... | ...... | ...... | ...... | ...... | ...... |
| Pennzoil Products Co.—Roosevelt | 8,000 | 8,500 | ...... | ...... | $^{1}$6,000 | 500 | $^{2}$2,000 | ...... | ...... | $^{4}$2,000 | *2,600 | ...... | ...... | ...... | ...... | ...... |
| Phillips 66 Co.—Woods Cross$^{1}$ | 25,000 | 26,000 | 4,800 | ...... | $^{2}$8,400 | 2,600 | $^{4}$6,000 | ...... | $^{4}$1,600 | $^{2}$11,000 | $^{2}$2,100 | $^{6}$2,600 | ...... | 1,700 | ...... | ...... |
| **Total** | **154,500** | **160,400** | **48,100** | **8,500** | **55,400** | **9,100** | **31,100** | ...... | **7,100** | **34,100** | **14,300** | **8,050** | ...... | **1,700** | ...... | **350** |

Solvent extraction: $^{1}$5,000 b/sd.

## VIRGINIA

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Oil Co.—Yorktown | 53,000 | 56,000 | 29,000 | $^{5}$13,500 | $^{1}$27,500 | 2,000 | $^{2}$10.200 | ...... | ...... | $^{1}$10,000<br>$^{5}$16,000 | *2,400 | ...... | ...... | ...... | ...... | 750 |
| **Total** | **53,000** | **56,000** | **29,000** | **13,500** | **27,500** | **2,000** | **10,200** | ...... | ...... | **26,000** | **2,400** | ...... | ...... | ...... | ...... | **750** |

## WASHINGTON

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic Richfield Co.—Ferndale | 164,000 | 172,000 | 95,000 | $^{5}$50,000 | ...... | ...... | $^{2}$56,000 | $^{1}$52,000 | $^{4}$18,000 | $^{1}$38,000 | ...... | ...... | ...... | ...... | $^{1}$80.0 | 2,500 |
| Chevron U.S.A. Inc.—Seattle | 5,000 | *5,263 | 6,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 5,000 | ...... | ...... |
| Shell Oil Co.—Anacortes | 85,000 | 89,000 | 36,000 | ...... | $^{1}$42,000 | 6,000 | $^{3}$25,000 | ...... | $^{3}$7,500 | $^{2}$32,000<br>$^{4}$20,500 | $^{1}$11,000 | $^{4}$2,750 | ...... | ...... | ...... | ...... |
| Sohio Oil Co. (BP America)—Ferndale | 77,000 | 79,000 | 28,000 | ...... | $^{2}$25,500 | 2,000 | $^{4}$11,800 | ...... | ...... | $^{1}$13,500<br>$^{4}$15,000 | $^{2}$5,900<br>*1,200 | ...... | ...... | ...... | ...... | ...... |
| Sound Refining Inc.—Tacoma | 11,900 | 12,754 | 6,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 3,600 | ...... | ...... |
| Texaco Refining & Marketing Inc.—Anacortes$^{1}$ | 117,000 | 120,000 | 50,000 | $^{5}$22,000 | $^{1}$45,000 | 4,000 | $^{1}$7,000<br>$^{2}$14,000 | ...... | ...... | $^{1}$22,000<br>$^{4}$13,000<br>$^{5}$15,000 | $^{1}$8,000<br>*2,200 | ...... | ...... | ...... | ...... | 1,200 |
| U.S. Oil & Refining Co.—Tacoma | *32,775 | 34,500 | 19,500 | ...... | ...... | ...... | $^{2}$6,000 | ...... | ...... | $^{1}$6,000<br>$^{2}$1,000<br>$^{4}$4,000 | ...... | $^{6}$1,500 | ...... | 8,000 | ...... | ...... |
| **Total** | **492,675** | **512,517** | **240,500** | **72,000** | **112,500** | **12,000** | **119,800** | **52,000** | **25,500** | **180,000** | **28,300** | **4,250** | ...... | **16,600** | **80.0** | **3,700** |

Solvent extraction: $^{1}$4,500 b/sd.

## WEST VIRGINIA

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phoenix Refining Co.—St. Mary's$^{1}$ | 19,180 | 20,000 | 2,000 | ...... | ...... | ...... | $^{1}$1,500 | ...... | ...... | ...... | ...... | ...... | 2,000 | ...... | ...... | ...... |
| Quaker State Oil Refining Corp.—Newell | 10,500 | 10,800 | 8,850 | ...... | ...... | ...... | $^{2}$3,400 | $^{3}$4,500 | ...... | $^{1}$3,900 | ...... | ...... | 4,440 | ...... | $^{1}$1.2 | ...... |
| **Total** | **29,680** | **30,800** | **10,850** | ...... | ...... | ...... | **4,900** | **4,500** | ...... | **3,900** | ...... | ...... | **6,440** | ...... | **1.2** | ...... |

Solvent extraction: $^{1}$900 b/sd.

## WISCONSIN

| Company and location | Crude capacity b/cd | Crude capacity b/sd | Vacuum distillation | Thermal operations | Cat cracking Fresh feed | Cat cracking Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Murphy Oil USA Inc.—Superior | 32,000 | 34,000 | 20,500 | ...... | $^{1}$11,000 | 1,000 | $^{2}$8,000 | ...... | $^{4}$5,800 | $^{1}$9,000 | $^{2}$1,300 | $^{5}$2,000 | ...... | 13,500 | ...... | ...... |

| Company and location | Crude capacity | | Charge capacity, b/sd | | | | | | | | Production capacity, b/sd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/cd | b/sd | Vacuum distillation | Thermal operations | — Cat cracking — Fresh feed | Recycle | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| **WYOMING** | | | | | | | | | | | | | | | | |
| Amoco Oil Co.—Casper | 40,000 | 41,000 | 17,000 | ...... | $^{1}$13,500 | 2,700 | $^{4}$7,000 | ...... | ...... | $^{1}$7,100 | $^{1}$2,500 | ...... | 1,500 | ...... | ...... | ...... |
| Frontier Oil & Refining Co.—Cheyenne | 36,100 | 38,000 | 19,500 | $^{4}$8,400 | $^{1}$12,000 | 500 | $^{2}$7,000 | ...... | $^{5}$8,000 | $^{1}$7,200 | $^{2}$3,000 | $^{4}$1,200 | ...... | 7,000 | ...... | ...... |
| Little America Refining Co.—Evansville | 22,000 | 24,000 | 8,600 | ...... | $^{1}$14,000 | 3,000 | $^{4}$6,000 | ...... | ...... | $^{1}$6,000<br>$^{2}$3,750<br>$^{5}$4,000 | ...... | ...... | ...... | 1,000 | ...... | ...... |
| Sinclair Oil Corp.—Sinclair | 54,000 | 55,000 | 30,000 | ...... | $^{1}$21,000 | 1,000 | $^{2}$14,500 | ...... | $^{3}$21,000 | $^{1}$14,500<br>$^{4}$12,000 | $^{1}$3,500<br>*700 | ...... | ...... | 5,000 | ...... | ...... |
| Wyoming Refining Co.—Newcastle | 12,500 | 13,500 | ...... | ...... | $^{2}$4,000 | 3,000 | $^{1}$2,750 | ...... | ...... | ...... | $^{2}$800 | ...... | ...... | ...... | ...... | ...... |
| Total | 164,600 | 171,500 | 75,100 | 8,400 | 64,500 | 10,200 | 37,250 | ...... | 29,000 | 54,550 | 10,500 | 1,200 | 1,500 | 13,000 | ...... | ...... |

## INACTIVE REFINERIES

1. Newhall Refining Co. Inc., Newhall, Calif.—18,800 b/cd.

Annual
PRODUCTION
[illegible]

## About this report. . .

The continued importance of enhanced oil recovery is reflected in the Journal's latest worldwide biennial survey.

Although chemical EOR in the U.S. has suffered because of high costs relative to crude oil prices, $CO_2$, low-molecular weight hydrocarbon injection, and steam are processes that are expanding worldwide. Noteworthy projects are the expansion of $CO_2$ floods in West Texas, hydrocarbon injection in Alaska, and steam in Indonesia.

This year the Journal also looks at heavy oil projects, those with crudes that could not be produced either by conventional primary or secondary techniques.

# $CO_2$ and HC injection lead EOR production increase

**Guntis Moritis**
Drilling/Production Editor

Oil production from $CO_2$ and low-molecular-weight hydrocarbon miscible/immiscible (HC) gas injection projects is rapidly increasing in the U.S., as the Journal's exclusive worldwide survey in this issue shows.

Since OGJ's previous worldwide biennial EOR survey in 1988 (covering the situation at the beginning of 1988), enhanced oil production has more than doubled from HC projects and increased by 49% from $CO_2$ projects (Table 1).

Total enhanced oil production in the U.S. at the start of 1990 was 656,700 bo/d or a 6.2% increase over the same period in 1988. The accompanying box with block diagram defines EOR processes covered in the alphabetical tables in this report. An indexed list of these tables and the abbreviations used are also covered in accompanying boxes.

Worldwide there has been little increase in EOR output although the survey shows an increase of 11.5% to some 1.2 million bo/d. This increase is misleading because the data for two large projects, the Duri field steamflood in Indonesia and the Intisar 103D field HC miscible project in Libya, were not included in the 1988 survey. The former came in too late and the latter was inadvertently left out.

After taking into account the 115,000 bo/d these two projects were producing at the start of 1988, the actual worldwide enhanced oil production has remained virtually the same with only a 0.1% increase.

A contact at the U.S.S.R.'s All-Union Scientific Research Oil & Gas Institute in Moscow says the Soviet Union has a large number of EOR projects scattered from Sakhalin Island in the east to the Ukraine in the west, and from the polar circle in the north to Azerbaijan in the south. He says that the U.S.S.R. does have active thermal, gaseous, chemical, and microbiological projects. He says there was not enough time to furnish details on each by this year's deadline for the survey. A total EOR production figure was also apparently not available.

This year's survey reveals that the more expensive enhanced oil recovery processes that involve chemical injection have experienced a dramatic decrease in the U.S. The number of projects with chemical EOR at the beginning of 1990 had dropped to 50 from the 124 projects at the beginning of 1988 (Table 2).

Table 1

## U.S. EOR production

| | b/d | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1980 | 1982 | 1984 | 1986 | 1988 | 1990 | Change from 1988, % |
| **Thermal** | | | | | | | |
| Steam | 243,477 | 288,396 | 358,115 | 468,692 | 455,484 | 444,137 | −2.5 |
| Combustion in situ | 12,133 | 10,228 | 6,445 | 10,272 | 6,525 | 6,090 | −6.7 |
| Hot water | — | — | — | 705 | 2,896 | 3,985 | 37.6 |
| **Total thermal** | **255,610** | **298,624** | **364,560** | **479,669** | **464,905** | **454,212** | **−2.3** |
| **Chemical** | | | | | | | |
| Micellar-polymer | 930 | 902 | 2,832 | 1,403 | 1,509 | 617 | −59.1 |
| Polymer | 924 | 2,927 | 10,232 | 15,313 | 20,992 | 11,219 | −46.6 |
| Caustic/alkaline | 550 | 580 | 334 | 185 | 0 | 0 | — |
| Surfactant | — | — | — | — | — | 20 | — |
| **Total chemical** | **2,404** | **4,400** | **13,398** | **16,901** | **22,501** | **11,856** | **−47.3** |
| **Gas** | | | | | | | |
| Hydrocarbon miscible/immiscible | — | — | 14,439 | 33,767 | 25,935 | 55,386 | 113.6 |
| $CO_2$ miscible | 21,532 | 21,953 | 31,300 | 28,440 | 64,192 | 95,591 | 48.9 |
| $CO_2$ immiscible | — | — | 702 | 1,349 | 420 | 95 | −77.4 |
| Nitrogen | — | — | 7,170 | 18,510 | 19,060 | 22,260 | 16.8 |
| Flue gas (miscible and immiscible | — | — | 29,400 | 26,150 | 21,400* | 17,300 | −19.2 |
| **Total gases** | **74,807** | **71,915** | **83,011** | **108,216** | **130,997*** | **190,632** | **45.5** |
| **Other** | | | | | | | |
| Carbonated waterflood | — | — | — | — | — | — | — |
| **Grand total** | **332,821** | **374,948** | **460,969** | **604,766** | **618,403*** | **656,700** | **6.2** |

*Corrected

Likewise, production from chemical projects has been halved to 11,856 bo/d from 22,501 bo/d in 1988. Observers say that the high cost of chemicals in most cases put these projects in jeopardy. Also the demise of the federal windfall profits tax took away the incentive for maintaining some such projects.

### Heavy oil

The 1990 survey also includes a look at heavy oil projects (Table L). The definition we used for heavy oil fields are those that could not be produced through conventional primary or secondary means, and were not mining projects.

All responses on active projects came from Canada and include 19 fields producing a total of 115,00[illegible] The largest by far i[illegible] Resources Canada [illegible] Cold Lake cyclic stea[illegible]ulation. The project started in 1964 and involves 1,200 wells. Current production is 88,060 bo/d.

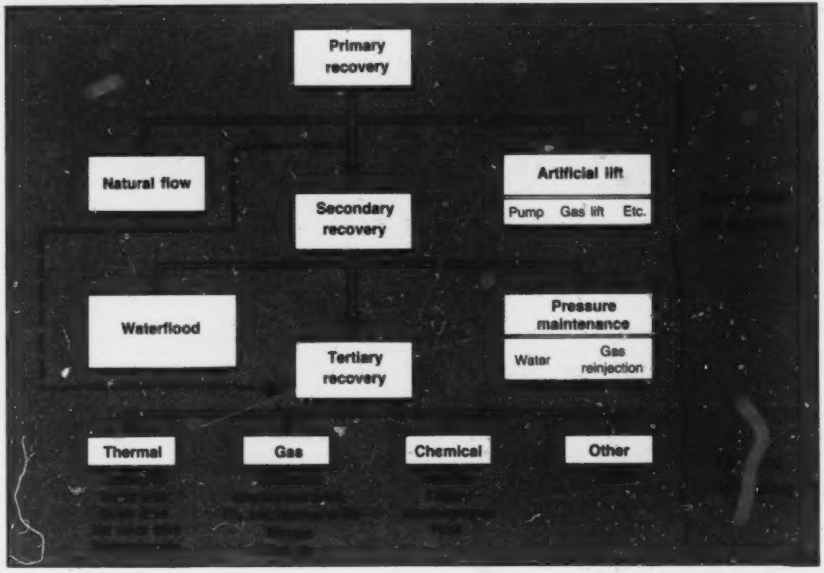
For 1990, eight projects are slated for start-up (Table M). Two are in the U.S., and the others are in Canada.

Table 2

## Active U.S. EOR projects

| | Number of projects | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1971 | 1974 | 1976 | 1978 | 1980 | 1982 | 1984 | 1986 | 1988 | 1990 | Change from 1988, % |
| **Thermal** | | | | | | | | | | | |
| Steam | 53 | 64 | 85 | 99 | 133 | 118 | 133 | 181 | 133 | 137 | 3.0 |
| Combustion in situ | 38 | 19 | 21 | 16 | 17 | 21 | 18 | 17 | 9 | 8 | −11.1 |
| Hot water | — | — | — | — | — | — | — | 3 | 10 | 9 | −10.0 |
| **Total thermal** | **91** | **83** | **106** | **115** | **150** | **139** | **151** | **201** | **152** | **154** | **1.3** |
| **Chemical** | | | | | | | | | | | |
| Micellar-polymer | 5 | 7 | 13 | 22 | 14 | 20 | 21 | 20 | 9 | 5 | −44.4 |
| Polymer | 14 | 9 | 14 | 21 | 22 | 55 | 106 | 178 | 111 | 42 | −62.2 |
| Caustic/alkaline | — | 2 | 1 | 3 | 6 | 10 | 11 | 8 | 4 | 2 | −50.0 |
| Surfactant | — | — | — | — | — | — | — | — | — | 1 | — |
| **Total chemical** | **19** | **18** | **28** | **46** | **42** | **85** | **138** | **206** | **124** | **50** | **−59.6** |
| **Gas** | | | | | | | | | | | |
| Hydrocarbon miscible-immiscible | 21 | 12 | 15 | 15 | 9 | 12 | 16 | 26 | 22 | 23 | 4.6 |
| $CO_2$ miscible | 1 | 6 | 9 | 14 | 17 | 28 | 40 | 38 | 49 | 52 | 6.1 |
| $CO_2$ immiscible | — | — | — | — | — | — | 18 | 28 | 8 | 4 | −50.0 |
| Nitrogen | — | — | — | — | — | — | 7 | 9 | 9 | 9 | 0.0 |
| Flue gas (miscible and immiscible) | | | | | 8 | 10 | 3 | 3 | 2 | 3 | 50.0 |
| **Total gases** | **22** | **18** | **24** | **29** | **34** | **50** | **84** | **104** | **90** | **91** | **1.11** |
| **Other** | | | | | | | | | | | |
| Carbonated waterflood | — | — | — | — | — | — | | | 1 | — | — |
| **Grand total** | **132** | **119** | **158** | **190** | **226** | **274** | **373** | **512** | **366** | **295** | **−19.4** |

# EOR recovery mechanisms



Recovery mechanisms

OGJ's EOR survey divides recovery mechanisms into four categories: thermal, gas, chemical, and other. Each of these categories is further broken down into several other distinct processes.

### Thermal

The four categories under thermal recovery are steam, combustion, hot water, and electromagnetic. Thermal recovery reduces the oil viscosity in the reservoir and lets the oil flow into the producing well.

For the cyclic steam injection method, or steam soak, one well is used for both injection and production. Steam is injected into the reservoir and left to soak to reduce the viscosity of the oil. Then the oil and water are produced back up the same well that was used for injection. In the Duri field, after three cycles, additional steam injection proved uneconomical.

A steamflood, or steam drive, usually consists of a pattern-type flood. Steam continuously injected into a central well reduces the oil viscosity in the reservoir and then pushes the oil, generated gases, and water to the surrounding producing wells. Steamfloods are commonly installed after cyclic steam injection has recovered most of the oil in the vicinity of a well bore.

Steam is typically economical in reservoirs that are shallower than 3,000 ft, contain oil less than 30° API, and have permeability greater than 200 md. Surfactants can be added to the steam to improve recovery.

Unlike a steam project where oil or gas is burned on the surface to generate steam, a combustion EOR process burns oil in the reservoir. The in situ combustion creates a steam bank, gas from the combustion process, and evaporated hydrocarbons that drive the reservoir oil, gas, and water into the producing well.

Either air or oxygen is injected to maintain combustion. Because no heat is lost in the well bore, combustion projects can be at a much greater depth than steam injection.

Hot water is similar to a waterflood, except that the heated water reduces the viscosity of the oil.

Electromagnetic heating is another way to decrease the viscosity of the oil. No large projects have yet been undertaken using this method.

### Gas

Both miscible and immiscible displacement processes are used. The miscible process can involve a concurrent, alternating, or subsequent injection of water. In immiscible displacement, the reservoir pressure and temperature are such that the injected gas is not miscible with the oil.

Carbon dioxide, nitrogen, and flue gas are the most common gases. Low-molecular weight hydrocarbons are also widely used in this type of process. The main application of miscible injection is for reservoirs with low-viscosity crude.

### Chemical

All of the chemical EOR processes involve augmenting waterflood performance. In these processes a slug or slugs of chemicals are injected followed by water. These processes improve recovery for crudes of low-to-moderate viscosity.

Polymers improve sweep efficiency by plugging high-permeability zones or reducing the mobility of the displacing fluid.

Foam is another way to lower the mobility of the displacing fluid and create a more uniform sweep. Surfactants are used to stabilize the foam.

In micellar/polymer flooding, along with the polymers, surfactants are injected into the reservoir to lower the interfacial tension between water and oil.

Caustic soda is one common low-cost alkaline that is used to increase the pH of the reservoir. Depending on the crude, the alkaline will react with the oil in the formation to create a surfactant that can reduce the interfacial tension between water and oil. Spontaneous emulsification and wettability alteration are two other effects that can improve oil recovery with alkaline injection. In alkaline flooding, the crude should have a high acid number and a low API gravity. Surfactants can also be combined with the injected alkalines to obtain additional oil recovery.

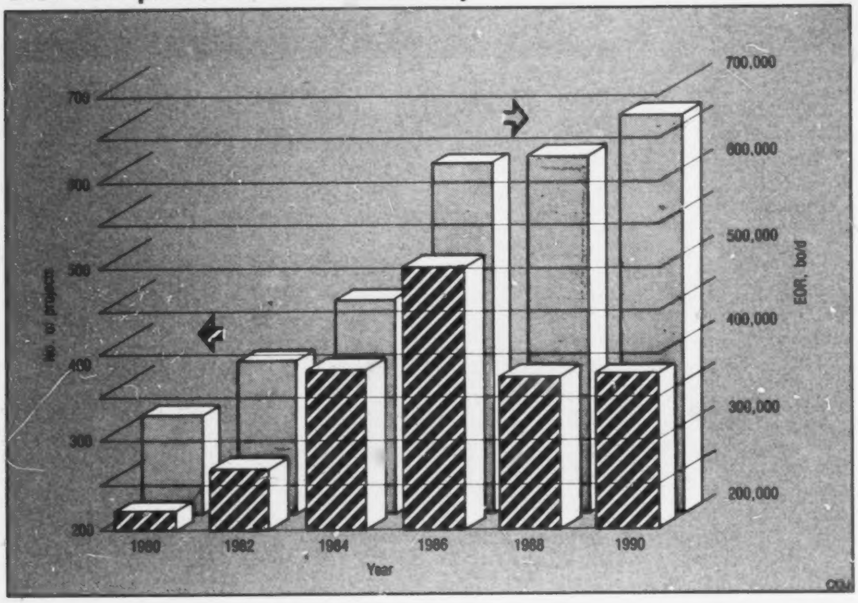
### Other

Microbial EOR is another way to enhance waterflooding. The injected micro-organisms and nutrients decompose reservoir oil to produce detergents, $CO_2$, and new cells. These products either mechanically or chemically release oil from reservoir pores.

To date, no large-scale microbial projects have been attempted. Micro-organisms have also been used in single well stimulation treatments.

Fig. 1

## U.S. EOR production climbs steadily



### Abbreviations

**Formation type**

Si: Sandstone
LS: Limestone
Dolo.: Dolomite
Congl.: Conglomerate
Tripol.: Tripolite
US: Unconsolidated sand

**Project maturity**

JS: Just started
HF: Half finished
NC: Nearing completion
C: Completed
PP: Postponed
Term: Terminated

**Previous production**

Prim.: Primary
WF: Waterflood
GI: Gas injection
C: Cyclic steam
HW: Hot water
SS: Steam soak
S: Steam
SF: Steam flood
HC: Hydrocarbon

**Project evaluation**

TETT: Too early to tell
Prom.: Promising
Succ.: Successful
Disc.: Discouraging

**Project scope**

P: Pilot project
FW: Field wide
LW: Lease wide
RW: Reservoir wide
Exp. L: Expansion likely
Exp. UL: Expansion unlikely

Planned investment is $51 million.

### International

The most noteworthy international project has been the continued expansion of the Duri, Indonesia, steamflood. P.T. Caltex Pacific Indonesia operates the project under a production-sharing contract with the Indonesian state oil company, Pertamina.

***THE WORLD'S LARGEST EOR project, the Duri steamflood, is located on the island of Sumatra in Indonesia. (Photo courtesy of P.T. Caltex Pacific Indonesia)***

Earlier this year, Duri became the largest EOR project in terms of daily production in the world, surpassing the production rate from the Kern River field in California. Steam injection in Duri started in 1985.

The current total production rate in Duri is about 160,000 bo/d, or 15,000 bo/d more than shown in our tabulation. The cut off date for our survey was the end of 1989.

A peak production of 330,000 bo/d is expected in Duri by 1993.

About 20% of this oil will be burned to generate steam for injection.

Ultimate tertiary recovery from this $1.8 billion project is estimated to be 2 billion bbl of oil. To date, $700 million has been invested. The remaining $1.1 billion is expected to be spent by 1996.

In Duri, development of four of the planned twelve areas has been completed. The total area developed will eventually grow to about 15,100 acres from the 4,000 acres shown in our tabulation.

The number of wells is scheduled to peak at 3,202 producers and 1,408 steam injectors. At the cut off date for our survey, 952 wells were producing and steam was being injected into another 288 wells.

## Guide to EOR project tabulations

A. U.S. planned EOR projects by type
B. Planned projects outside U.S. by country
C. Producing Canadian EOR projects
D. Completed, terminated Canadian projects
E. Producing EOR projects outside U.S. and Canada
F. Completed, terminated projects outside U.S. and Canada
G. Producing thermal EOR in U.S.
H. Producing $CO_2$, gas EOR in U.S.
I. Producing chemical EOR projects in U.S.
J. Completed, terminated U.S. projects
K. Producing Canadian heavy oil EOR projects
L. Worldwide planned heavy oil projects

Table A

## U.S. planned EOR projects by type

| Project type | Operator | Field | Location | Pay zone | Size, acres | Depth, ft | Gravity, °API | Start date |
|---|---|---|---|---|---|---|---|---|
| $CO_2$ immiscible | Chevron | Bay Merchand | Offshore Louisiana | Pliocene-Miocene | 3 wells | 8,500 | 15-20 | 6/90 |
| $CO_2$ miscible | Citronelle Unit | Citronelle | Mobile County, Ala. | Rodessa | 1,080 | 11,000 | 42 | 1/90 |
| $CO_2$ miscible | Conoco | South Huntley | Garza County, Tex. | San Andres | 480 | 3,100 | 37 | 1/90 |
| $CO_2$ miscible | Conoco | Huntley East | Garza County, Tex. | San Andres | 700 | 3,100 | 37 | 1/92 |
| $CO_2$ miscible | Mobil | Postle | Texas County, Okla. | Morrow | 23,000 | 6,100 | 40 | 6/91 |
| $CO_2$ miscible | Mobil | Slaughter | Cochran, Hockley, Tex. | San Andres | 4,800 | 5,000 | 32 | 1990 |
| $CO_2$ miscible | Mobil | Salt Creek | Kent County, Tex. | Canyon | 12,100 | 6,300 | 39 | 1990 |
| $CO_2$ miscible | Mobil | Slaughter | Cochran County, Tex. | San Andres | 1,280 | 4,900 | 32 | 1990 |
| $CO_2$ miscible | Mobil | Levelland | Cochran, Hockley, Tex. | San Andres | 12,100 | 4,800 | 32 | 1990 |
| $CO_2$ miscible | Mobil | Russell | Gaines County, Tex. | Lower Clearfork | 4,820 | 7,500 | | 1992 |
| $CO_2$ miscible | Phillips | Aneth | San Juan County, Utah | Desert Creek | 3,250 | 5,500 | 40 | 1/91 |
| $CO_2$ miscible | Phillips | Jess Burnes | Reeves County, Tex. | Delaware | 100 | 3,300 | 36 | 1/90 |
| $CO_2$ miscible | Phillips | Leamex | Lea County, N.M. | Paddock | 120 | 6,200 | 38 | 2/90 |
| $CO_2$ miscible | Phillips | Ranger Lake | Lea County, N.M. | Bough C | 320 | 9,000 | 40 | 1/90 |
| $CO_2$ miscible | Phillips | South Cowden | Ector County, Tex. | Grayburg/San Andres | 600 | 4,700 | 35 | 1/91 |
| $CO_2$ miscible | Phillips | Vacuum | Lea County, N.M. | San Andres | 320 | 4,500 | 37 | 1/91 |
| $CO_2$ miscible | Shell | Wasson | Yoakum Co., Tex. | San Andres | 9,588 | 5,200 | 33 | 1992 |
| $CO_2$ miscible | Texaco | Paradis | St. Charles, La. | 10,000 feet | 102 | 11,400 | 38.5 | 1/90 |
| $CO_2$ miscible | Texaco | Paradis | St. Charles, La. | Main Pay | 88 | 10,500 | 27.5 | 1/90 |
| HC miscible | ARCO | Kuparuk River Unit | North Slope, Alaska | Kuparuk "A" & "C" | 40,000 | 6,200 | 24 | 6/90 |
| HC miscible | ARCO | Prudhoe Bay | Alaska | | 3,200 | | | 1990-91 |
| HC miscible | Marathon Oil | Sand Dunes | Converse County, Wyo. | Muddy S.S. | 6,400 | 12,500 | 40 | 12/90 |
| HC miscible | Marathon Oil | So. Coles Levee Unit | Kern County, Calif. | Stevens (FI) | 40 | 9,700 | 34 | 4/90 |
| Micellar | ARCO | Sabine Tram SW | Newton County, Tex. | Wilcox | 2,010 | 11,525 | 49 | 12/89 |
| Microbial | Phillips | N. Burbank | Osage County, Okla. | Burbank | 40 | 2,900 | 30 | 6/90 |
| Polymer | Mitchell Energy | Alba | Wood County, Tex. | Sub Clarksville | 1,132 | 4,000 | 15.5 | 1990 |
| Polymer | Phillips | N. Burbank | Osage County, Okla. | Burbank | 160 | 2,900 | 39 | 3/90 |
| Steam | Bechtel | Shallow Oil Zone | Kern, Calif. | Sub-Scalez | 20 | 2,800 | 27 | 1991 |
| Steam | Mobil | Bayou Bleu | Iberville Parish, La. | Miocene | 16 | 11-1,600 | 16 | 1/91 |
| Steam | Mobil | Lost Hills | Kern County, Calif. | Etchegoin | 80 | 400 | 15 | 1/90 |
| Steam | Mobil | Lost Hills | Kern County, Calif. | Etchegoin | 100 | 400 | 15 | 10/90 |
| Steam | Mobil | Saratoga | Hardin County, Tex. | Miocene | 20 | 850 | 20 | 1/90 |
| Steam/polymer | Unocal | Brea-Olinda | Orange Co., Calif. | 1st-3rd Pliocene | 100 | 3,500 | 16 | 2/90 |
| Surfactant | Marathon Oil | Yates | Pecos County, Tex. | San Andres | 80 | 1,500 | 30 | 11/89 |

Table B

## Planned projects outside U.S. by country

| Type project | Operator | Field | Country | Pay zone | Size, acres | Depth, ft | Gravity, °API | Start date |
|---|---|---|---|---|---|---|---|---|
| $CO_2$ immiscible | Trintoc | Oropouche | Trinidad | Retrench Sand | 175 | 2,160 | 29 | 3/90 |
| $CO_2$ miscible | Pan Canadian | Countess | Canada/Alta. | Glauconite | 80 | 4,000 | 30 | 10/90 |
| Combustion | Pan Canadian | Countess | Canada/Alta. | Glauconite | 80 | 4,000 | 30 | 7/90 |
| HC miscible | Chevron Canada | Acheson | Canada/Alta. | Leduc D-3 | 3,810 | 5,000 | 39 | 1991 |
| HC miscible | Esso Res. Canada Ltd. | Boundary Lake Unit #1 | Canada/B.C. | Triassic Bound | 320 | 4,300 | 34 | 10/90 |
| HC miscible | Mobil Oil Canada | Rainbow Twp 110,R6,W6M | Canada/Alta. | Keg River QQ | 200 | 5,300 | 38 | 1/91 |
| $N_2$ miscible | Mobil Oil Canada | Carson Creek North | Canada/Alta. | BHL | 4,000 | 8,799 | 45 | 1/91 |
| Polymer | OMV | Matzen | Austria | 9th Tortonian | 66 | 4,330 | 21 | 7/90 |
| Steam | BEB | Georgsdorf III | West Germany | Valanginian | 80 | 2,100-2,800 | 27 | 10/90 |

***A PUMPING UNIT at the Duri EOR steamflood on Sumatra, Indonesia.***

The dominant process for Canadian EOR remains HC miscible/immiscible injection, and accounts for 82.8% of the 152,953 bo/d Canadian EOR production. Because of the increase in HC projects to 51 from 42 in 1988, Canadian EOR production has increased by 5.8% from the previous survey.

Venezuelan enhanced oil production decreased during the past 2 years.

OGJ's previous survey showed 44 projects producing 216,360 bo/d of enhanced production.

Although the number of projects has only dropped by 2 to 42, enhanced oil production has decreased 45% to 118,788 bo/d. Three of the largest drops were: Bare (F.O.) field from 28,000 to 8,280 bo/d; East Tia Juana field, L.L. zone from 18,000 to 6,800 bo/d; and Bachaquero field from 41,600 to 4,000 bo/d.

The response for the Bachaquero field noted that the steam soak activity was being constrained.

### Steam in the U.S.

Oil production from steam EOR in the U.S. is continuing a slow decline from the peak reached in 1986 of 468,692 bo/d. A 2.7% decline occurred between the 1986 and 1988 surveys, followed by a further decline of 2.5% from 1988 to 1990. Although declining, steam still accounts for 67.8% of all U.S. enhanced oil recovery. The current rate is 444,137 bo/d.

The six reported steam projects that are planned in the U.S. between 1990 to 1991, because of their limited size of 336 acres, will not greatly influence the production decline from steam EOR projects.

Environmental laws are inhibiting the expansion of steam projects in California. Crude burned to generate steam has a relatively high sulfur content. But one positive development that might spur additional enhanced oil production is the three proposed pipelines to bring natural gas into the steam EOR areas of California.

As long as natural gas maintains a sufficient differential to the price of oil, gas should replace much of the crude oil burned in generating steam.

Better steam EOR economics may spur new or expanded development.

The Kern River Gas Transmission Co.'s Wyoming-California pipeline will move Rocky Mountain and Canadian gas to California. The Wyoming-California Pipeline Co. (WyCal) is another pipeline that will serve California's EOR customers. The third line bringing gas into the Bakersfield, Calif., area is Mojave Pipeline Co.'s Arizona-California link. All three lines are scheduled to start by late 1991.

## Producing Canadian EOR projects

| Operator | Field | Province | Start date | Area, acres | – Number wells – | | Pay zone | Formation type | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Prod. | Inj. | | | | |
| **Alkaline** | | | | | | | | | | |
| Amoco Canada* | Cessford | Alta. | 7/84 | 680 | 19 | 7 | Basal Colorado | S | 24.0 | 350 |
| Amoco Canada* | David | Alta. | 3/86 | 245 | 22 | 7 | Lloydminster | S | 29.0 | 1,400 |
| **$CO_2$ miscible** | | | | | | | | | | |
| Home Oil | Silverdale | Sask. | 12/85 | 160 | 9 | 3 | Sparky | S | 29.0 | 2,000 |
| Shell Canada | Harmattan East | Alta. | 8/88 | 1,600 | 20 | 8 | Mississippian Turner Val | Dolo. | 14.0 | 10-300 |
| Vikor | Joffre Viking | Alta. | 12/82 | 320 | 4 | 4 | Viking | S | 13.0 | 500 |
| Vikor | Joffre Viking | Alta. | 8/85 | 480 | 6 | 3 | Viking | S | 13.0 | 500 |
| Vikor | Joffre Viking | Alta. | 6/88 | 560 | 5 | 1 | Viking | S | 13.0 | 500 |
| **Combustion** | | | | | | | | | | |
| Mobil Oil Canada | Battrum | Sask. | 10/66 | 4,920 | 76 | 15 | Battrum/Roseray | S | 26.0 | 1,288 |
| Mobil Oil Canada | Battrum | Sask. | 8/67 | 2,400 | 35 | 7 | Battrum/Roseray | S | 25.0 | 930 |
| Mobil Oil Canada | Battrum | Sask. | 11/65 | 680 | 22 | 3 | Roseray | S | 27.0 | 980 |
| Mobil Oil Canada | Fosterton Northwest | Sask. | 1/70 | 200 | 1 | 0 | Roseray | S | 29.0 | 858 |
| Pancanadian | Countess Upper Mannville B Pool | Alta. | 1/83 | 40 | 4 | 1 | Glauconite S.S. | S | 26.0 | 800 |
| Murphy | Evehill | Sask. | 6/80 | 180 | 21 | 9 | Cummings Waseca | S | 34.0 | 6,000 |
| **Foam flood** | | | | | | | | | | |
| Signalta Resources | Pembina | Alta. | 10/86 | 2,240 | 13 | 1 | Ostracod | S | 12.0 | 70 |
| **Hydrocarbon miscible** | | | | | | | | | | |
| Amoco Canada | Ante Creek Unit 1 | Alta. | 1968 | 6,080 | 15 | 10 | Beaverhill Lake | LS | 6.0 | 9 |
| Amoco Canada | Bigoray Nisku B | Alta. | 2/80 | 251 | 5 | 1 | Nisku D-2 | LS | 5.0 | 1,130 |
| Amoco Canada* | Kaybob South | Alta. | 7/84 | 8,000 | 40 | 9 | Triassic | Dolo. | 11.5 | 92 |
| Amoco Canada | Nipisi | Alta. | 2/84 | 28,480 | 168 | 68 | Gilwood | S | 18.0 | 200 |
| Amoco Canada | Rainbow S. | Alta. | 8/72 | 490 | 5 | 2 | Keg River | Dolo. | 6.0 | 40 |
| Amoco Canada | South Swan Hills | Alta. | 1973 | 28,480 | 163 | 51 | Beaverhill Lake | LS | 8.0 | 40 |
| Amoco Canada* | Willesden Green | Alta. | 5/75 | 26,000 | 107 | 55 | Cardium | S | 11.0 | 5 |
| Canadian Hunter Expl. | Brassey | B.C. | 1/89 | 6,043 | 10 | 6 | Artex | S | 16.6 | 137 |
| Chevron Canada Resources | Acheson D-3A | Alta. | 7/87 | 610 | 15 | 1 | Leduc D3 | LS | 12.0 | 5,000 |
| Chevron Canada Resources | Bigoray Nisku F | Alta. | 3/87 | 150 | 2 | 1 | Nisku F | LS | 10.0 | 250 |
| Chevron Canada Resources | Kaybob North BHL Unit #1 | Alta. | 1/88 | 5,400 | 34 | 9 | Beaverhill Lake | LS | 7.5 | 50 |
| Chevron Canada Resources | Mitsue, Stage 1 & 2 | Alta. | 5/85 | 17,280 | 140 | 55 | Gilwood | S | 13.4 | 282 |
| Chevron Canada Resources | Pembina Nisku A | Alta. | 2/84 | 400 | 3 | 1 | Nisku A | LS | 8.0 | 280 |
| Chevron Canada Resources | Pembina Nisku D | Alta. | 11/85 | 400 | 5 | 1 | Nisku F | LS | 12.0 | 750 |
| Chevron Canada Resources | Pembina Nisku F | Alta. | 6/86 | 200 | 3 | 1 | Nisku F | LS | 12.7 | 680 |
| Chevron Canada Resources | W. Pembina Nisku A | Alta. | 8/81 | 200 | 2 | 1 | Nisku A | LS | 10.0 | 750 |
| Chevron Canada Resources | W. Pembina Nisku C | Alta. | 4/84 | 130 | 2 | 1 | Nisku C | LS | 11.0 | 1,100 |
| Chevron Canada Resources | W. Pembina Nisku D | Alta. | 5/81 | 320 | 2 | 1 | Nisku D | LS | 10.0 | 300 |
| Esso Resources Canada† | Pembina 'G' Pool | Alta. | 9/89 | 328 | 4 | 1 | Nisku | Dolo. | 8.0 | 900 |
| Esso Resources Canada† | Pembina 'K' Pool | Alta. | 1984 | 126 | 2 | 1 | Nisku | Dolo. | 12.7 | 2,020 |
| Esso Resources Canada† | Pembina 'L' Pool | Alta. | 1985 | 625 | 5 | 2 | Nisku | Dolo. | 10.5 | 1,060 |
| Esso Resources Canada† | Pembina 'M' Pool | Alta. | 1983 | 192 | 2 | 1 | Nisku | Dolo. | 9.0 | 540 |
| Esso Resources Canada† | Pembina 'O' Pool | Alta. | 11/83 | 346 | 2 | 1 | Nisku | Dolo. | 11.8 | 3,100 |
| Esso Resources Canada† | Pembina 'P' Pool | Alta. | 10/83 | 420 | 4 | 1 | Nisku | Dolo. | 10.3 | 2,400 |
| Esso Resources Canada† | Pembina 'Q' Pool | Alta. | 2/85 | 301 | 2 | 1 | Nisku | Dolo. | 9.8 | 1,970 |
| Esso Resources Canada† | Wizard Lake | Alta. | 1969 | 2,725 | 49 | 14 | Leduc D-3A | Dolo. | 10.5 | 1,378 |
| Esso Resources Canada Ltd. | Judy Creek | Alta. | 5/85 | 29,050 | 186 | 65 | Beaverhill Lake | LS | 9.0 | 43 |
| Esso Resources Canada Ltd. | Judy Creek | Alta. | 1/87 | 3,290 | 52 | 22 | Beaverhill Lake | LS | 9.2 | 41 |
| Esso Resources Canada Ltd. | Rainbow Keg River "FF" Pool | Alta. | 5/72 | 102 | 2 | 1 | 344 ft | Dolo. | 8.5 | |
| Esso Resources Canada Ltd. | Rainbow Keg River "T" Pool | Alta. | 5/69 | 222 | 3 | 1 | 394 ft | Dolo. | 8.6 | |
| Esso Resources Canada Ltd. | Rainbow Keg River "Z" Pool | Alta. | 2/71 | 221 | 5 | 1 | 265 ft | Dolo. | 4.25 | |
| Esso Resources Canada Ltd. | Redwater | Alta. | 1/85 | 1,000 | 25 | 4 | Leduc D3 | LS | 5.0 | 10-5,000 |
| Gulf Canada | Fenn-Big Valley | Alta. | 4/83 | 1,268 | 26 | 7 | Nisku | Dolo. | 8.0 | 400 |
| Gulf Canada | Goose River | Alta. | 10/86 | 2,847 | 14 | 5 | Beaverhill Lake | LS | 8.0 | 240 |
| Home Oil | Swan Hills | Alta. | 10/85 | 19,440 | 196 | 39 | Beaverhill Lake | LS | 8.5 | 54 |
| Husky Oil§ | Rainbow B Pool | Alta. | 6/84 | 2,500 | 28 | 9 | Keg River | LS | 8.0 | 300 |
| Husky Oil§ | Rainbow E Pool | Alta. | 6/72 | 173 | 5 | 1 | Keg River | LS | 12.0 | 300 |
| Husky Oil§ | Rainbow EEE Pool | Alta. | 4/70 | 150 | 2 | 1 | Keg River | LS | 16.8 | 500 |
| Husky Oil§ | Rainbow G Pool | Alta. | 10/72 | 163 | 3 | 1 | Keg River | LS | 8.0 | 300 |
| Husky Oil§ | Rainbow H Pool | Alta. | 6/73 | 165 | 3 | 1 | Keg River | LS | 9.4 | 200 |
| Husky Oil§ | Rainbow KRA Pool | Alta. | 12/68 | 633 | 17 | 2 | Keg River | LS | 10.1 | 100 |
| Husky Oil§ | Rainbow KRD Pool | Alta. | 3/76 | 85 | 1 | 1 | Keg River | LS | 10.0 | 200 |
| Husky Oil§ | Rainbow O Pool | Alta. | 2/70 | 703 | 9 | 1 | Keg River | LS | 6.0 | 150 |
| Mobil Oil Canada | Rainbow | Alta. | 7/83 | 320 | 5 | 1 | Keg River | Dolo./LS | 8.5 | 100-1,000 |
| Mobil Oil Canada | Rainbow | Alta. | 9/72 | 800 | 14 | 2 | Keg River | Dolo./LS | 8.6 | 500 |
| Petro-Canada | Brazeau River | Alta. | 9/81 | 640 | 3 | 1 | Nisku | LS | 7.0 | 50 |
| Petro-Canada | Brazeau River | Alta. | 9/80 | 640 | 2 | 1 | Nisku | LS | 10.0 | 388 |
| Petro-Canada | Brazeau River | Alta. | 11/80 | 640 | 2 | 1 | Nisku | LS | 10.0 | 35 |
| Petro-Canada | Caroline | Alta. | 9/84 | 12,620 | 27 | 12 | Cardium | S | 10.0 | 12 |
| Shell Canada | [illegible]nette | Alta. | 11/86 | 150 | 4 | 1 | Leduc D-3 | Dolo. | 7.0 | 10-50 |
| Shell Canada | Vi[illegible]a Hills | Alta. | 11/89 | 4,575 | 50 | 14 | Beaverhill Lake | LS | 9.0 | 1-800 |

### Chemical

The hardest hit by the low crude oil prices have been the chemical projects. Of the 91 terminated or completed projects in the U.S., 54 of them were chemical.

Three of these were micellar/polymer, while the rest were polymer. In addition to these, operators requested that an additional 21 polymer projects be deleted from our survey.

### Gas

Because of the existing infrastructure in the West Texas area, $CO_2$ enhanced oil recovery remains strong and is expected to grow, judging from the number of planned future projects. The infra-

(Continued on p. 82.)

Table C

| Depth, ft | Reservoir oil — Gravity, °API | cp | °F. | Previous prod. | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3,000 | 24.0 | 24.0 | 84 | Prim./WF | 62.0 | | NC | 340 | 100 | Prom. | Yes | P(Exp.L) |
| 2,450 | 22.0 | 34.0 | 75 | Prim./WF | 60.0 | | HF | | | TETT | | FW |
| 1,837 | 16.0 | 5,000 | 60 | Prim. | 82.0 | 74.6 | HF | 130 | 130 | Succ. | Yes | P(Exp. UL) |
| 8,500 | 39.0 | 0.3 | 198 | WF | 40.0 | | JS | 190 | 140 | TETT | | Exp. L |
| 4,000 | 42.0 | 1.14 | 133 | WF | 40.0 | 28.0 | HF | | | Succ. | No | P(Exp.L) |
| 5,140 | 42.0 | 1.14 | 133 | WF | 38.0 | 27.0 | HF | | | Prom. | | P(Exp.L) |
| 5,075 | 42.0 | 1.14 | 133 | WF | 36.0 | | JS | | | Prom. | | P(Exp. L) |
| 2,900 | 18.0 | 70.3 | 110 | Prim. | 66.0 | | HF | 3,330 | 3,330 | Succ. | Yes | FW |
| 2,900 | 16.0 | 70.0 | 110 | Prim. | 62.0 | | HF | 1,635 | 1,635 | Succ. | Yes | FW |
| 2,900 | 18.0 | 70.0 | 110 | Prim. | 70.0 | | HF | 1,400 | 1,400 | Succ. | Yes | FW |
| 3,100 | 24.0 | 16.0 | 125 | WF | 62.0 | 40.0 | NC | 50 | 50 | Prom. | No | P(Exp. UL) |
| 3,550 | 26.0 | 6.0 | 100 | WF | 45.0 | 25.0 | NC | | | Prom. | | Exp. L |
| 2,450 | 14.3 | 2,750 | 70 | Prim. | 100.0 | 80.0 | HF | 350 | 350 | Prom. | Yes | P(Exp. UL) |
| 6,859 | 42.0 | 0.35 | 135 | G | 78.0 | 31.0 | NC | 168 | 168 | Prom. | Yes | FW |
| 11,000 | 40.0 | 0.14 | 233 | Prim. | 90.0 | 60.0 | NC | 750 | 750 | Succ. | Yes | FW |
| 7,500 | 34.0 | 1.4 | 169 | Prim. | 70.0 | 30.0 | HF | 800 | 800 | Succ. | Yes | FW |
| 6,981 | 40.0 | 0.419 | 190 | WF | 46.0 | 31.0 | NC | 4,500 | 2,460 | Prom. | Yes | FW |
| 5,500 | 41.0 | 0.84 | 131 | WF | 30.0 | 5.0 | HF | 24,000 | 10,000 | Succ. | Yes | FW |
| 6,200 | 40.0 | 0.3 | 183 | Prim. | | | NC | 1,250 | 1,250 | Succ. | Yes | FW |
| 8,500 | 38.0 | 0.4 | 225 | Prim./WF | 35.0 | 13.0 | NC | 13,200 | 13,200 | Succ. | Yes | FW |
| 6,400 | 38.0 | 0.55 | 136 | Prim. | 87.0 | 73.0 | NC | 1,600 | 1,600 | Disc. | No | FW |
| 9,850 | 57.0 | 0.097 | 210 | | 98.0 | 33.0 | JS | 3,800 | | Prom. | | FW:(Exp.L) |
| 5,000 | 39.0 | 0.85 | 139 | Prim. | 90.0 | 29.0 | JS | 2,400 | 1,400 | Succ. | Yes | FW |
| 10,500 | 37.0 | 0.8 | 175 | WF | 90.0 | 5.0 | JS | 4,000 | 1,100 | Succ. | Yes | FW |
| 9,780 | 42.0 | 0.19 | 234 | WF | 30.0 | 5.0 | JS | 5,600 | | TETT | No | FW |
| 5,000 | 41.0 | 0.65 | 147 | WF | 30.0 | 19.0 | JS | 14,300 | 9,000 | Succ. | Yes | FW |
| 10,000 | 41.0 | 0.3 | 210 | WF | 80.0 | 5.0 | JS | 4,450 | 1,700 | Succ. | Yes | FW |
| 9,000 | 41.0 | 0.7 | 176 | WF | 90.0 | 5.0 | HF | 6,400 | 1,700 | Succ. | Yes | FW |
| 8,000 | 40.0 | 0.5 | 208 | WF | 75.0 | 43.3 | JS | 2,271 | 705 | TETT | | FW |
| 10,000 | 42.0 | 0.3 | 228 | Prim. | 90.0 | 5.0 | HF | 4,466 | 2,766 | Succ. | Yes | FW |
| 10,300 | 42.0 | 0.3 | 218 | WF | 75.0 | 9.0 | HF | 6,000 | 2,500 | Succ. | Yes | FW |
| 10,000 | 42.0 | 0.2 | 218 | Prim. | 90.0 | 5.0 | HF | 3,800 | 2,300 | Succ. | Yes | FW |
| 9,541 | 43.2 | 0.33 | 204 | Prim. | 80.0 | 5.0 | HF | 3,500 | 2,100 | Prom. | Yes | FW |
| 9,469 | 43.6 | 0.37 | 198 | Prim | 82.0 | 5.0 | HF | 2,900 | 1,450 | Prom. | Yes | FW |
| 9,415 | 40.9 | 0.42 | 199 | WF | 88.0 | 5.0 | HF | 7,633 | 2,379 | Prom. | Yes | FW |
| 9,333 | 41.1 | 0.14 | 198 | Prim. | 93.0 | 5.0 | HF | 3,131 | 1,461 | Prom. | Yes | FW |
| 9,332 | 43.4 | 0.32 | 190 | Prim. | 84.0 | 5.0 | JS | 2,200 | 1,490 | Prom. | Yes | FW |
| 9,531 | 45.4 | 0.36 | 200 | Prim. | 87.0 | 5.0 | JS | 5,800 | 3,610 | Prom. | Yes | FW |
| 9,421 | 41.3 | 0.42 | 196 | Prim. | 91.0 | 5.0 | HF | 3,280 | 1,710 | Prom. | Yes | FW |
| 6,500 | 38.0 | 0.54 | 167 | Prim. | 93.0 | 5.0 | NC | 9,600 | 9,600 | Succ. | Yes | FW |
| 8,850 | 41.6 | 0.38 | 206 | WF | 84.0 | 42.0 | HF | 14,750 | 8,200 | Succ. | | FW |
| 9,150 | 42.1 | 42.0 | 206 | WF | 83.0 | 43.0 | JS | 4,720 | 1,760 | Succ. | | FW |
| 4,160 | 37.0 | 0.59 | 188 | Prim. | 90.0 | | NC | | | Succ. | | RW |
| 4,330 | 40.0 | 0.69 | 188 | Prim. | 88.0 | | NC | | | Succ. | | RW |
| 4,040 | 38.0 | 0.547 | 190 | Prim. | 73.5 | | HF | | | Succ. | | RW |
| 3,280 | 35.0 | 2.85 | 94 | Prim. | 75.0 | 20-25.0 | HF | 685 | 550 | Prom. | No | P |
| 5,249 | 32.8 | 1.34 | 136 | Prim. | 33.0 | | HF | 590 | 590 | Succ. | Yes | FW |
| 9,200 | 41.0 | 0.4 | 234 | WF | | | HF | 2,831 | 1,573 | Prom. | | Exp. L. |
| 8,300 | 41.0 | 0.4 | 225 | WF | 30.0 | 5.0 | JS | 20,300 | 7,100 | Succ. | Yes | FW |
| 6,000 | 39.0 | 0.83 | 180 | WF | 52.0 | 23.0 | JS | 4,635 | 4,635 | Prom. | Yes | FW |
| 5,932 | 39.0 | 0.439 | 175 | Prim. | 91.0 | 27.0 | HF | 1,900 | 1,900 | Succ. | Yes | FW |
| 6,065 | 37.0 | 0.542 | 180 | Prim. | 95.0 | 29.0 | NC | 70 | 70 | Succ. | Yes | FW |
| 6,151 | 39.0 | 0.485 | 185 | Prim. | 92.0 | 28.0 | HF | 1,528 | 1,528 | Succ. | Yes | FW |
| 6,210 | 39.0 | 0.596 | 187 | Prim. | 92.0 | 28.0 | HF | 572 | 572 | Succ. | Yes | FW |
| 6,330 | 43.0 | 0.29 | 195 | Prim. | 90.0 | 30.0 | HF | 2,610 | 2,610 | Succ. | Yes | FW |
| 6,310 | 40.0 | 0.426 | 195 | Prim. | 90.0 | 27.0 | NC | 141 | 141 | Succ. | Yes | FW |
| 6,053 | 42.0 | 0.28 | 180 | Prim. | 87.0 | 26.0 | NC | 650 | 650 | Succ. | Yes | FW |
| 5,500 | 39.0 | 0.46 | 190 | WF | 40.0 | 10.0 | HF | 600 | 600 | Prom. | Yes | FW |
| 5,500 | 39.0 | 0.47 | 184 | GI/WF | 80.0 | 10.0 | HF | 1,900 | 1,900 | Succ. | Yes | FW |
| 10,091 | 42.0 | 0.38 | 216 | Prim. | 90.0 | 15.0 | HF | 3,100 | 3,100 | Succ. | Yes | FW |
| 10,215 | 44.0 | 0.4 | 218 | Prim. | 90.0 | 10.0 | HF | 7,400 | 7,400 | Succ. | Yes | FW |
| 10,544 | 46.0 | 0.2 | 222 | Prim. | 90.0 | 15.0 | HF | 2,500 | 2,500 | Succ. | Yes | FW |
| 8,200 | 46.0 | 0.25 | 173 | Prim. | 85.0 | 45.0 | HF | 1,900 | 1,550 | Succ. | Yes | FW |
| 11,600 | 47.0 | 0.13 | | WF | | | NC | 160 | 135 | Disc. | | Exp. UL |
| 9,500 | 34.0 | 0.53 | 221 | WF | 56.0 | 36.0 | JS | 11,000 | | TETT | | Exp. L |

## Producing Canadian EOR projects—continued

| Operator | Field | Province | Start date | Area, acres | – Number wells – Prod. | Inj. | Pay zone | Formation type | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hot Water** | | | | | | | | | | |
| Alberta Energy | S. Jenner Up. Mannville J. Pool | Alta. | 9/89 | 2 | 3 | 1 | Glauconitic | S | 25.0 | 1,560 |
| **Polymer** | | | | | | | | | | |
| BP Exploration | Chauvin South | Alta. | 2/88 | 300 | 10 | 3 | Sparky E | S | 15-27 | 1,076 |
| Chevron Canada Resources | Taber Mannville D Unit #1 | Alta. | 6/87 | 480 | 7 | 2 | Mannville D | S | 22.3 | 1,140 |
| Encor Energy | Rapdan Unit | Sask. | 1/86 | 440 | 12 | 5 | Upper Shaunavon | S | 17.0 | 85 |
| **Steam** | | | | | | | | | | |
| Amoco Canada | Elk Point | Alta. | 4/89 | 33 | 9 | 4 | Lower Cummings | S | 30.0 | 1,500 |
| Amoco Canada | Lindbergh | Alta. | 11/85 | 120 | 12 | 12 | Lower Cummings | US | 32.0 | 4,000 |
| Esso Resources Canada† | Lone Rock | Sask. | 11/84 | 45 | 13 | 3 | Sparky | S | 34.4 | 2,800 |
| Home Oil | Kitscoty | Alta. | 6/81 | 160 | 12 | 15 | Sparky B | S | 27.6 | 905 |
| Mobil Oil Canada | Celtic (Multi-zone) | Sask. | 9/88 | 160 | 16 | | General Petro & Waseca | S | 35.0 | 1-2,000 |
| Norcen | Provost | Alta. | 3/86 | 20 | 8 | 1 | McLaren | S | 27-30.0 | 4,000 |
| Sceptre Resources | Tangleflags North | Sask. | 12/87 | 17 | 1 | 3 | Lloydminster Sand | US | 32.5 | 5,000 |

*Former operator: * Dome, † Texaco, §Canterra Energy.

## Completed, terminated Canadian projects

| Operator | Field | Province | Start date | Area, acres | – Number wells – Prod. | Inj. | Pay zone | Formation type | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|
| **Caustic-polymer** | | | | | | | | | | |
| Pancanadian | Horsefly Lake | Alta. | 12/84 | 34 | 5 | 4 | Lower Mannville | S | 18.0 | 280 |
| **$CO_2$ miscible** | | | | | | | | | | |
| Shell Canada | Midale | Sask. | 10/85 | 5 | 3 | 4 | Midale | LS/Dolo. | 16.0 | 3 |
| **Combustion** | | | | | | | | | | |
| Husky | Tangleflags | Sask. | 1985 | 240 | 19 | 3 | GP | US | 33.0 | 4,000 |
| Mobil Oil Canada | Kitscoty | Alta. | 9/75 | 1,040 | 84 | 7 | Sparky | S | 34.0 | 2,000 |
| **Electromagnetic** | | | | | | | | | | |
| Canada Northwest Energy | Wildmere | Alta. | 1/86 | 120 | 3 | | Lloydminster | S | 30.0 | 800 |
| **Steam** | | | | | | | | | | |
| Canada Northwest Energy | Atlee Buffalo | Alta. | 9/86 | 640 | 10 | | Glauconite | S | 30.0 | 2,000 |
| Husky | Frog Lake | Alta. | 1985 | 20 | 4 | 1 | Colony | US | 33.0 | 2,500 |
| Husky | Charlotte Lake | Alta. | 1985 | 20 | 2 | 2 | Rex | US | 33.0 | 3,000 |
| Mobil Oil Canada | Celtic | Sask. | 4/85 | 50 | 5 | | General Petro. | S | 35.0 | 2,000 |
| Mobil Oil Canada | Celtic | Sask. | 10/80 | 125 | 25 | | Waseca | S | 35.0 | 1,000 |
| **Steam soak** | | | | | | | | | | |
| Phillips Petroleum | Coleville | Sask. | 11/84 | 35 | 2 | 2 | Bakken | S | 25.0 | 400 |

## Producing EOR projects outside U.S. and Canada

| Country | State/area | Operator | Project type | Field | Start date | Area, acres | No. wells Prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Colombia | Mid. Magdalena basin | Texas Petroleum | Steam | Cocorna | 3/87 | 15 | 8 | 3 | Oligocene B | S | 28 | 700 |
| Colombia | Mid. Magdalena basin | Texas Petroleum | Steam | Teca | 2/84 | 3,000 | 200 | | Oligocene A & B | S | 28 | 1,200 |
| France | Paris | Elf Aquitaine | Polymer | Chateaurenard (Courtenay) | 1/89 | 250 | 12 | 4 | Neocomian | S | 30 | 2,000 |
| France | | Elf Aquitaine | Steam | Lacq Superieur | 1977 | 30 | 8 | 1 | Senonien | LS | 15 | 1 |
| France | Paris | Elf Aquitaine | Steam | Lacq Superieur | 1/89 | 30 | 8 | 1 | Senonien | LS | 15 | 10 |
| Hungary | | NKFV | $CO_2$ | Nacylengyel | 10/68 | 2,890 | 104 | 11 | I-IV Rudistic | LS | 1.06 | 1,000 |
| Hungary | | NKFV | $CO_2$ | Nagylengyel | 9/80 | 200 | 5 | 1 | Triassic | Dolo. | 2.5 | 1,000 |
| Hungary | | NKFV | $CO_2$ | Budafa | 1981 | 1,013 | 77 | 60 | Zala Kerettye | S | 22 | 110 |
| Hungary | | NKFV | Combustion | Demjen East | 1986 | 14 | 8 | 3 | Oligocene c,da,df,e | S | 19 | 100 |
| Indonesia | | Total | Micellar polymer | Handil | 1982 | 4 | 1 | 3 | | S | 30 | 1,000 |
| Indonesia | Pekanbaru | PT Caltex | Steam | Duri | 4/85 | 4,000 | 952 | 288 | Pertama - Kedua | US | 32-36 | 1,550 |
| Libya | | Zueitina Oil | HC miscible | Intisar 103D | 1/69 | 3,325 | 20 | 6 | "D" Reef | LS | 23.9 | 226 |
| Trinidad | Forest Reserve | Trintoc | $CO_2$ immiscible | Forest Reserve (Area 2102) | 6/76 | 58 | 6 | 3 | Forest sands | S | 30 | 175 |
| Trinidad | Forest Reserve | Trintoc | $CO_2$ immiscible | Forest Reserve (Area 2121) | 1/74 | 29 | 4 | 3 | Forest sands | S | 30 | 150 |

Table C

| | Reservoir oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth, ft | Gravity, °API | cp | °F. | Previous prod. | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
| 2,950 | 14.0 | 170.0 | 90 | Prim. | 75.0 | | JS | 95 | | TETT | | P |
| 2,100 | 21.5 | 43.1 | 78 | WF | 60.0 | | JS | 440 | | Prom. | | P |
| 3,200 | 18.0 | 55.0 | 121 | WF | 92.0 | 7.0 | JS | 17,600 | 16,400 | TETT | Yes | FW |
| 4,500 | 23.0 | 10.0 | 132 | WF | 55.0 | 43.0 | HF | 880 | 660 | Succ. | Yes | P (Exp. L) |
| 2,000 | 12.0 | 25,000 | 73 | Prim./C | 80.0 | | JS | | | TETT | | P |
| 1,950 | 12.0 | 15,000 | 75 | Prim. | 72.0 | | HF | | | Prom. | Yes | P(Exp L) |
| 1,900 | 16.0 | 800 | 70 | Prim. | 82.0 | | NC | 200 | 200 | Prom. | No | P(Exp. UL) |
| 2,066 | 13.0 | 8,000 | 60 | Prim. | 80.0 | 52.0 | NC | 400 | 325 | Succ. | Yes | P(Exp. UL) |
| 1,600 | 13.0 | 2-5,000 | 60 | Prim. | 70.0 | | JS | 800 | | TETT | | P |
| 2,430 | 12.0 | 2,000 | 80 | Prim. | 82.0 | 45.0 | JS | 420 | 420 | Prom. | No | P(Exp.L) |
| 1,476 | 12-13.0 | 13,000 | 66 | Prim. | 80.0 | 15.0 | HF | 600 | 550 | Prom. | Yes | P |

Table D

| | Reservoir oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth, ft | Gravity, °API | cp | °F. | Previous prod. | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
| 3,200 | 23.0 | 13 | 94 | WF | 51 | 40 | Term. | | | | | Exp. UL |
| 4,600 | 28.0 | 3 | 150 | Prim./WF | 35 | | C | | | | | P |
| 1,700 | 14.5 | 4,000 | 74 | Prim. | 77 | | Term. | 550 | 550 | Succ. | Yes | UL |
| 1,800 | 12.2 | 15,000 | 70 | Prim. | 85 | 60-68 | Term. | 610 | 305 | Disc. | No | P |
| 2,100 | 12 | 8,000 | 75 | Prim. | 85 | | Term. | 80 | 60 | Prom. | Yes | P (Exp. L) |
| 2,900 | 14.5 | 800 | 80 | Prim. | 80 | 1 | Term. | 0 | 0 | Succ. | Yes | Exp. L |
| 1,400 | 12 | 100,000 | 60 | | 80 | 65 | Term. | 45 | 45 | Disc. | No | UL |
| 1,400 | 10.8 | 107,000 | 70 | | 80 | | Term. | | | Disc. | No | UL |
| 1,576 | 13 | 7,000 | 67 | Prim. | 69 | 46 | Term. | 290 | 190 | Prom. | | P (Exp. L) |
| 1,500 | 13 | 5,380 | 61 | Prim. | 70 | 47 | Term. | 630 | 630 | Prom. | | P (Exp. L) |
| 2,600 | 14 | 1,000 | 84 | WF | | | C | 60 | 22 | Disc. | No | P |

Table E

| | Reservoir oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth, ft | Gravity, °API | cp | °F. | Previous prod. | Satur. % start | Satur. % end | Project matur. | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
| 2,100 | 12.8 | 2,965 | | | 57 | 19 | HF | 390 | 190 | Prom. | | P (Exp. L) |
| 2,100 | 12.8 | 2,965 | | Prim. | | | HF | 17,000 | 8,500 | Succ. | Yes | FW |
| 1,950 | 27 | 40 | 86 | Prim. | 45 | | JS | 337 | 161 | TETT | Yes | |
| 1,950-2,100 | 22 | 20 | 150 | Prim. | 45 | | NC | 1,000 | 400 | Succ. | Yes | FW |
| 1,950-2,100 | 22 | 20 | 150 | Prim. | 45 | | JS | | | Prom. | | P |
| 6,700 | 18 | 22 | 237 | Prim. | | | JS | 3,200 | 3,200 | Prom. | | |
| 7,400 | 16 | 92 | 248 | Prim. | | | NC | 130 | 130 | Succ. | | |
| 3,000 | 42 | 0.8 | 147 | Prim. | | | NC | 500 | 500 | Succ. | | |
| 820 | 39 | 7 | 78 | Prim. | 55 | | HF | 60 | 52 | Prom. | | Exp.L |
| 4,500 | 33 | 0.4 | 115 | WF | 35 | | | 400 | 400 | | | |
| 625 | 22.7 | 157 | | Prim. | 62 | 25 | JS | 145,000 | 115,000 | Succ. | Yes | Exp. L |
| 8,849 | 39.2 | 0.46 | 226 | | 80 | 18 | NC | 40,000 | 40,000 | Succ. | Yes | FW |
| 3,000 | 29 | 3 | 120 | Prim. | 56 | | JS | 25 | 25 | Prom. | | RW |
| 2,600 | 17 | 66 | 120 | Prim. | 60 | | JS | 10 | 10 | Prom. | | RW |

## Producing EOR projects outside U.S. and Canada—continued

| Country | State/area | Operator | Project type | Field | Start date | Area, acres | No. wells Prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trinidad | Forest Reserve | Trintoc | $CO_2$ immiscible | Forest Reserve (Area 2124) | 1/86 | 184 | 2 | 1 | Forest sands | S | 31.5 | 283-370 |
| Trinidad | | Trintoc | $CO_2$ cyclic | Forest Reserve | 5/84 | | 6 | | Forest sands | S | 30 | 150-300 |
| Trinidad | Point Fortin | Trintoc | Steam | P/F Cruse "E" Steam Proj. | 2/86 | 66 | 28 | 3 | Cruse E | S | 31 | 95 |
| Trinidad | Point Fortin | Trintoc | Steam | Parrylands | 7/81 | 90 | 46 | 6 | Forest sands | S | 30 | 500 |
| Trinidad | Forest Reserve | Trintoc | Steam | F/R Project III | 7/65 | 135 | 53 | 14 | Forest zone 5.1 | S | 33 | 340 |
| Trinidad | Forest Reserve | Trintoc | Steam | F/R Phase I Reactivation | 8/76 | 58 | 10 | 0 | Forest sands | S | 31 | 205 |
| Trinidad | Forest Reserve | Trintoc | Steam | F/R Phase I West Expansion | 12/88 | 50 | 29 | | Forest sands | S | 30 | 430 |
| Turkey | Ankara | TPAO | $CO_2$ immiscible | Bati Raman | 3/86 | 10,709 | 96 | 23 | Garzan | LS | 18 | 58 |
| Venezuela | Anzoategui | Corpoven S.A. | Gas | Oveja | 8/61 | 5,467 | 31 | 4 | I2L,3(YAC.OG-503) | S | 37 | 2,500 |
| Venezuela | Anzoategui | Corpoven S.A. | Gas | Oveja | 1/67 | 1,325 | 4 | 1 | L1L(YAC.OM-101) | S | 31 | 2,940 |
| Venezuela | Anzoategui | Corpoven S.A. | Gas | Oveja | 1/64 | 2,422 | 14 | 2 | J-3(OM-100) | S | 28 | 10,000 |
| Venezuela | Monagas | Corpoven S.A. | Gas | Oritupano | 9/76 | 1,054 | 7 | 1 | A-7(YAC.ORM-33) | S | 30 | 1,000 |
| Venezuela | Anzoategui | Corpoven S.A. | Gas | Oveja | 5/64 | 1,686 | 9 | 2 | L1L(YAC.OM-104) | S | 30.4 | 2,642 |
| Venezuela | Campo Cerro Negro | Lagoven S.A. | Steam | B.E.P.-Cerro Negro | 1984 | 49,090 | 144 | | Ofic. Morichal-Memb. | S | 32 | 7,000 |
| Venezuela | Campo Jobo | Lagoven S.A. | Steam | Jobo | 12/69 | 4,329 | 18 | | Ofic. Jobo Member | S | 32 | 2,500 |
| Venezuela | Campo Jobo | Lagoven S.A. | Steam | Jobo - P.E.T.C. | 8/85 | 267 | 17 | | Oficina | S | 30 | 8,000 |
| Venezuela | Campo Jobo | Lagoven S.A. | Steam | Jobo | 12/69 | 27,522 | 99 | | Ofic. Mor-Member | S | 31 | 5,000 |
| Venezuela | Campo Pilon | Lagoven S.A. | Steam | West Pilon | 12/69 | 1,065 | 29 | | Oficina-1 | S | 29.1 | 5,000 |
| Venezuela | Zulia | Lagoven S.A. | Steam | Bachaquero | 12/80 | 343 | 2 | | Bachaquero Superior | S | 23 | 1,500 |
| Venezuela | Zulia | Lagoven S.A. | Steam | Lagunillas | 2/71 | 9,343 | 308 | 2 | Bachaquero | S | 34 | 4,000 |
| Venezuela | Zulia | Lagoven S.A. | Steam | Tia Juana | 2/70 | 1,692 | 25 | | Lagunillas Inferior | S | 31 | 1,250 |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 3/69 | 1,773 | 145 | | L.L. | S | 38.1 | 780 |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 4/65 | 420 | 59 | | U.L.H. | S | 35 | |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 4/59 | 339 | 33 | | L.L. | S | 38.1 | |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 8/69 | 415 | 24 | | L.L. | S | 38.1 | |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 11/79 | 3,101 | 267 | | L.L. | S | 33.7 | |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 9/64 | 415 | 36 | | L.L. | S | 38.1 | 3,000 |
| Venezuela | Zulia | Maraven S.A. | Steam | Main Tia Juana | 10/63 | 873 | 82 | | L.L. | S | 38.1 | 1,400 |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 8/68 | 2,629 | 224 | | L.L. | S | 38.1 | 3,000 |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 8/69 | 1,642 | 131 | | L.L. | S | 38.1 | 1,300 |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 4/70 | 2,565 | 220 | | U.L.H. | S | 35 | |
| Venezuela | Zulia | Maraven S.A. | Steam | Main Tia Juana | 7/67 | 1,271 | 114 | | L.L. | S | 38.1 | 675 |
| Venezuela | Zulia | Maraven S.A. | Steam | Main Tia Juana | 7/67 | 1,500 | 134 | | L.L. | S | 38.1 | 750 |
| Venezuela | Zulia | Maraven S.A. | Steam | Main Tia Juana | 6/68 | 141 | 15 | 7 | L.L. | S | 33 | 675 |
| Venezuela | Zulia | Maraven S.A. | Steam | Main Tia Juana | 10/67 | 2,221 | 197 | | L.L. | S | 38.1 | 750 |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 1/70 | 3,025 | 147 | | L.L. | S | 33.7 | |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 1/74 | 1,830 | 135 | 21 | L.L. | S | 38.1 | 780 |
| Venezuela | Zulia | Maraven S.A. | Steam | Bachaquero | 10/84 | 7,795 | 539 | | Post-Eoceno | S | 37.3 | 600 |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 2/61 | 36 | 7 | | L.L. | S | 38 | 1,300 |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 7/67 | 618 | 54 | | U.L.H. | S | 35 | |
| Venezuela | Zulia | Maraven S.A. | Steam | Main Tia Juana | 6/66 | 141 | 15 | | L.L. | S | 38.1 | 675 |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 11/80 | 3,565 | 299 | | U.L.H. | S | 35 | |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 8/70 | 2,114 | 175 | | U.L.H. | S | 35 | |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 5/68 | 2,667 | 232 | | L.L. | S | 38.1 | |
| Venezuela | Zulia | Maraven S.A. | Steam | East Tia Juana | 12/68 | 1,956 | 168 | | L.L. | S | 38.1 | |
| Venezuela | Zulia | Maraven S.A. | Steam | Lagunillas | 1/70 | 76 | 7 | | L.L. | S | 33.7 | |
| Venezuela | Anzoategui | Corpoven S.A. | Steam | Bare (F.O.) | 3/85 | 16,452 | 47 | 48 | U1,3(YAC.MFB-53) | US | 31.9 | 6,600 |
| Venezuela | Anzoategui | Corpoven S.A. | Steam | Arecuna (F.O.) | 2/85 | 1,668 | 45 | 5 | 5 | US | 30.7 | 5,800 |
| Venezuela | Anzoatogui | Corpoven S.A. | Steam | Bare (F.O.) | 3/87 | 8,066 | 61 | 65 | U2,3(YAC.MFB-23) | US | 28.6 | 5,000 |
| Venezuela | Anzoategui | Corpoven S.A. | Steam | Arecuna (F.O.) | 12/83 | 1,344 | 15 | 15 | T(YAC.MFA-52) | US | 30.6 | 4,500 |
| West Germany | Lower Saxony | Wintershall AG | Hot Water | Emlichheim 14 | 10/67 | 64 | 5 | 1 | Valenginian | S | 30 | 6,000 |
| West Germany | Lower Saxony | Wintershall AG | Hot Water | Emlichheim 17 | 10/74 | 82 | 9 | 2 | Valenginian | S | 30 | 6,000 |
| West Germany | Lower Saxony | Wintershall AG | Hot Water | Emlichheim 11 | 9/73 | 70 | 8 | 1 | Valenginian | S | 30 | 6,000 |
| West Germany | Lower Saxony | Wintershall AG | Hot Water | Emlichheim 07 | 10/67 | 82 | 5 | 1 | Valenginian | S | 30 | 6,000 |
| West Germany | Northwest | Preussag AG | Polymer | Edesse-Nord | 11/85 | 4 | 3 | 2 | Wealden | S | 24 | 1,200 |
| West Germany | Northwest | Preussag AG | Polymer | Vorhop-Knesebeck | 11/89 | 345 | 3 | 1 | Dogger-Beta | S | 28 | 1,000 |
| West Germany | | RWE-DEA* | Polymer | Hankensbuettel Westblock 4 | 4/77 | 70 | 7 | 2 | Upper Dogger-Beta | S | 28 | 2,000-4,000 |
| West Germany | | RWE-DEA* | Polymer | Hankensbuettel Westblock 2 | 5/79 | 75 | 6 | 3 | Upper Dogger-Beta | S | 28 | 2,000-4,000 |
| West Germany | | RWE-DEA* | Polymer | Westblock | 1980 | 410 | 13 | 3 | Upper Dogger-Beta | S | 28 | 2,000-4,000 |
| West Germany | | RWE-DEA* | Polymer | Hankensbuettel, South Block | 1/84 | 15 | 2 | 1 | Dogger-Beta | S | 26 | 1,000-2,000 |
| West Germany | | RWE-DEA* | Polymer | Ploen OST | 1/89 | 30 | 3 | 1 | Dogger-Beta | S | 19 | 200-1,500 |
| West Germany | | RWE-DEA* | Polymer | Hohne | 1/84 | 73 | 4 | 3 | Dogger-Beta | S | 26 | 2,000 |
| West Germany | Lower Saxony | Wintershall AG | Polymer | Bockstedt | 9/84 | 57 | 4 | 1 | Valenginian | S | 23 | 4,000 |
| West Germany | Emsland | BEB | Steam | Ruhlermoor II | 8/86 | 360 | 40 | 4 | Valanginian | S | 27-31.0 | 600-1,000 |
| West Germany | Lower Saxony | BEB | Steam | Georgsdorf I | 1/75 | 165 | 19 | 2 | Valanginian | S | 25 | 460-1,150 |
| West Germany | Lower Saxony | BEB | Steam | Georgsdorf II | 12/79 | 144 | 23 | 3 | Valenginian | S | 25 | 1,000-1,300 |
| West Germany | Lower Saxony | BEB | Steam | Ruhlermoor I | 11/80 | 220 | 30 | 4 | Valenginian | S | 28-30.0 | 300-1,000 |
| West Germany | Emsland | BEB | Steam | Ruhlermoor III | 12/87 | 400 | 40 | 6 | Valenginian | S | 25-28 | 300-800 |
| West Germany | Lower Saxony | Wintershall AG | Steam | Ruehlertwist | 12/78 | 237 | 26 | 3 | Valenginian | S | 28 | 5,000 |
| West Germany | Lower Saxony | Wintershall AG | Steam | Emlichheim 06 | 5/81 | 121 | 15 | 4 | Valenginian | S | 30 | 6,000 |

Former operator: *Texaco AG

## Completed, terminated projects outside U.S. and Canada

| Country | State/area | Operator | Type projects | Field | Start date | Area, acres | No. wells Prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Austria | | OMV | Caustic | Matzen/Scho | 7/80 | 33 | 5 | 1 | Torton 9th | S | 23.5 | 300 |
| Austria | | OMV | Caustic | Matzen/Scho | 7/80 | 33 | 5 | 1 | Torton 9th | S | 23.5 | 300 |
| Austria | | OMV | Steam | Maustrenk | 7/80 | 123 | 19 | 3 | Schlier | | 24 | 147 |
| Congo | | Elf Congo | Steam | Emeraude-Offshore | 1/82 | 9 | 8 | 2 | Senonien | S | 25 | 80 |
| England | | BP | Micellar-polymer | Bothamsall | 7/83 | 10 | 3 | 1 | Sub-Alton | S | 12 | 14 |
| France | | Elf Aquitaine | Micellar-polymer | Chateaurenard | 1/84 | 71 | 9 | 4 | Necomian | S | 30 | 1,300 |
| France | | Elf Aquitaine | Polymer | Chateaurenard | 1/85 | 12 | 4 | 1 | Necomian | S | 30 | 1,000 |
| Venezuela | Monagas | Corpoven S.A. | Gas | Oritupano | 2/79 | 1,100 | 6 | 1 | A-9(YAC.ORM-27) | S | 28 | 1,300 |
| Venezuela | Campo Jobo | Lagoven S.A. | Steam | Jobo Picv | 3/81 | 90 | 22 | 6 | Morichal-1 | S | 32 | 10,000 |
| Venezuela | Zulia | Lagoven S.A. | Steam | Lagunillas | 10/66 | | 2 | | Lagunillas Inferior | S | 38 | 2,150 |
| Venezuela | Zulia | Lagoven S.A. | Steam | Bachaquero | 6/70 | 55 | | | Bachaquero | S | 30 | 1,761 |

Table E

| | Reservoir oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depth, ft** | **Gravity, °API** | **cp** | **°F.** | **Previous prod.** | **Satur. % start** | **Satur. % end** | **Project matur.** | **Total prod., b/d** | **Enh. prod., b/d** | **Project eval.** | **Profit** | **Project scope** |
| 3,850 | 25 | 5.7 | 120 | WF | 44 | | JS | 60 | 50 | TETT | | RW |
| 2,500 | 20-25.0 | 66-90 | 120 | Prim. | 60 | | JS | 10 | 10 | Prom. | | P (Exp. L) |
| 1,200-1,600 | 16-18.0 | 150-200 | 110-115 | Prim. | 58 | 18 | JS | 270 | 270 | Prom. | | FW |
| 1,000-1,200 | 11.5 | 5,000 | 110 | Prim. | 75 | 20 | JS | 640 | 640 | Prom. | | FW |
| 1,000-1,300 | 15.7 | 148 | 110 | Prim. | 70 | 20 | HF | 1,300 | 1,300 | Succ. | Yes | FW |
| 1,200 | 19 | 32 | 105 | Prim. | 57 | 15 | JS | 125 | 125 | Prom. | | RW |
| 1,500 | 12.3-17.8 | 160 | 105 | Prim. | 67 | 25 | JS | 75 | 75 | TETT | | P (Exp. L) |
| 4,265 | 13 | 592 | 129 | | 78 | | HF | 7,400 | 6,800 | Succ. | | FW |
| 3,150 | 15 | 38 | 150 | Prim. | 90 | 67 | HF | 5,000 | 5,000 | Prom. | Yes | FW |
| 3,430 | 21 | 5.5 | 154 | WF | 90 | 63 | NC | 1,300 | 1,300 | Succ. | Yes | FW |
| 3,300 | 20 | 52 | 149 | WF | 90 | 50 | HF | 2,250 | 2,250 | Succ. | Yes | FW |
| 5.150 | 20.5 | 4.9 | 146 | Prim. | 90 | 72 | HF | 550 | 550 | Succ. | Yes | FW |
| 3,350 | 18 | 12.5 | 152 | WF | 90 | 65 | NC | 2,600 | 2,600 | Succ. | Yes | FW |
| 2,800 | 8.5 | 5,500 | | Prim. | 80 | | HF | 10,000 | 8,000 | Succ. | Yes | P (Exp. L) |
| | 12.6 | 80 | | Prim. | 80 | | JS | 2,500 | 180 | Succ. | Yes | FW |
| 4,025 | 8.5 | 1,850 | | Prim. | 75 | | HF | 2,500 | 2,000 | Succ. | Yes | P (Exp. L) |
| 3,600 | 8.5 | 1,850 | | Prim. | 85 | | JS | 27,100 | 1,430 | Succ. | Yes | FW |
| 3,200 | 9.5 | 1,850 | | Prim. | 82.2 | | JS | 4,350 | 450 | Succ. | Yes | FW |
| 3,400 | 14 | 185 | 135 | Prim. | 85 | | JS | 9 | | TETT | No | P (Exp. L) |
| 2,690 | 12 | 600 | 128 | Prim. | 84 | | HF | 13,511 | 7,216 | Succ. | Yes | FW |
| 2,537 | 15 | 93 | 119 | | 72 | | HF | 1,870 | 870 | Prom. | Yes | |
| 1,700 | 11.9 | 2,000 | 111 | Prim. | 92.7 | 74.5 | HF | 4,320 | 3,400 | Prom. | Yes | |
| 2,100 | 11.4 | 3,500 | 117 | Prim. | 96.9 | 58.7 | NC | 2,510 | 1,150 | Succ. | Yes | FW |
| 1,500 | 12.2 | 1,000 | 108 | Prim. | 92.6 | 72.3 | HF | 490 | 150 | Prom. | Yes | FW |
| 850 | 10.5 | 10,000 | 95 | Prim. | 99.9 | 84.6 | HF | 810 | 810 | Prom. | Yes | FW |
| 2,615 | 15 | 580 | 126 | Prim. | 83.3 | 68.8 | HF | 3,526 | 1,690 | Prom. | Yes | FW |
| 1,250 | 12 | 3,000 | 104 | Prim. | 95.6 | 78.6 | HF | 500 | 330 | Prom. | Yes | FW |
| 1,750 | 13.1 | 750 | 113 | | 86 | 74 | NC | 2,036 | 1,297 | Prom. | Yes | FW |
| 1,000 | 11.6 | 4,000 | 104 | Prim. | 94.6 | 79.6 | HF | 3,217 | 2,550 | Prom. | Yes | FW |
| 1,250 | 10.2 | 12,000 | 102 | Prim. | 99.9 | 89.9 | HF | 2,325 | 2,325 | Prom. | Yes | FW |
| 1,750 | 11.8 | 2,500-11,500 | 115 | Prim. | 97.3 | 89.4 | HF | 12,150 | 6,500 | Prom. | Yes | FW |
| 1,220 | 13.1 | 6,000 | 123 | Prim. | 94.3 | 80.8 | HF | 2,188 | 1,375 | Prom. | Yes | FW |
| 1,400 | 11.8 | 1,000 | 110 | Prim. | 91.1 | 76 | HF | 3,195 | 1,950 | Prom. | Yes | FW |
| 1,250 | 13.1 | 1,000 | 113 | Prim. | 88 | 68 | | 3,100 | 2,000 | Prom. | Yes | P |
| 1,746 | 13.1 | 4,100 | 110 | Prim. | 95.1 | 80.9 | HF | 5,924 | 4,700 | Prom. | Yes | FW |
| 2,500 | 15.2 | 500-4,500 | 122 | Prim. | 88 | 74.3 | HF | 2,840 | 1,130 | Prom. | Yes | FW |
| 1,590 | 12 | 1,000 | 111 | | 81 | 56 | HF | 7,500 | 6,800 | Succ. | Yes | FW |
| 2,000 | 13 | 300-800 | 117 | Prim. | 85 | 73 | JS | 8,800 | 4,000 | Prom. | Yes | FW |
| 1,000 | 9.5 | 12,000 | 105 | Prim. | 100 | 76.9 | NC | 140 | 140 | Prom. | Yes | P |
| 2,100 | 11.4 | 3,500 | 117 | Prim. | 9 | 7 | NC | 3,080 | 1,400 | Succ. | Yes | FW |
| 1,250 | 13.1 | 1,300 | 104 | Prim. | 92 | 78 | NC | 120 | 25 | Prom. | Yes | FW |
| 2,398 | 11 | 2,000-3,700 | 125 | Prim. | 90.6 | 77.9 | HF | 16,260 | 5,510 | Prom. | Yes | FW |
| 1,725 | 11.4 | 4,000-9,000 | 118 | Prim. | 97.8 | | HF | 7,380 | 3,620 | Prom. | Yes | FW |
| 1,200 | 12 | 500 | 104 | | 93.6 | 82.5 | HF | 4,510 | 3,600 | Prom. | Yes | FW |
| 1,250 | 11.7 | 7,500 | 106 | Prim. | 97.5 | 82.5 | HF | 4,174 | 3,450 | Prom. | Yes | FW |
| 2,600 | 15.2 | 250 | 125 | Prim. | 73.7 | 63.5 | NC | 270 | 220 | Succ. | Yes | P |
| 2,650 | 9.3 | 376 | 131 | Prim. | 88 | 75 | HF | 26,675 | 17,340 | Succ. | Yes | RW (Exp. L) |
| 2,850 | 10 | 370 | 135 | Prim. | 82 | 74 | NC | 505 | 50 | Disc. | No | P (Exp. UL) |
| 3,050 | 9.2 | 351 | 136 | Prim. | 83 | 75 | HF | 177,000 | 8,280 | Succ. | Yes | RW (Exp. L) |
| 3,150 | 9.8 | 560 | 140 | Prim. | 80 | 72 | NC | 2,875 | 1,150 | Prom. | Yes | RW |
| 2,550 | 24.5 | 175 | 95 | WF | 73 | 58 | NC | 230 | 230 | Succ. | Yes | FW |
| 2,300 | 24.5 | 175 | 95 | WF | 66 | 55 | HF | 210 | 200 | Succ. | Yes | FW |
| 2,550 | 24.5 | 175 | 95 | WF | 72 | 68 | NC | 85 | 80 | Succ. | Yes | FW |
| 2,400 | 24.5 | 175 | 95 | WF | 70 | 56 | NC | 210 | 210 | Succ. | Yes | FW |
| 1,200 | 36 | 8 | 73 | WF | 53 | 37 | NC | 13 | 5 | Succ. | No | P (Exp. L) |
| 3,600 | 33 | 4 | 133 | WF | 65.5 | 55.2 | JS | 300 | 180 | TETT | | RW |
| 4,900 | 27 | 13 | 136 | WF | 69 | 29 | NC | 120 | 90 | Succ. | Yes | Exp. L |
| 4,900 | 28 | 13 | 136 | WF | 72 | 33 | NC | 320 | 250 | Succ. | Yes | Exp. L |
| 4,900 | 25 | 17 | 136 | WF | 60 | 50 | NC | 200 | 160 | Succ. | Yes | Exp. L |
| 4,800 | 32 | 6 | 136 | WF | 65 | 47 | HF | 130 | 90 | Succ. | Yes | Exp. L |
| 9,400 | 35 | 1.3 | 195 | WF | 34 | | JS | 150 | 0 | TETT | | P |
| 3,800 | 32.6 | 5.3 | 133 | WF | 67 | | HF | 150 | 50 | TETT | | |
| 4,100 | 34 | 11 | 130 | WF | 39 | 33 | HF | 125 | 50 | Prom. | | P |
| 1,700-2,100 | 25 | 120 | | Prim. | 78 | | HF | 2,880 | 2,220 | Succ. | Yes | FW |
| 2,130-2,790 | 27 | 120 | 95 | Prim. | | | HF | 1,120 | 975 | Succ. | Yes | |
| 2,130-2,790 | 27 | 120 | 95 | Prim. | | | HF | 1,340 | 1,020 | Succ. | Yes | |
| 2,070-2,460 | 25 | 120 | 96 | Prim. | | | HF | 1,780 | 1,520 | Succ. | Yes | |
| 1,700-2,100 | 25 | 120 | 96 | WF | | | JS | 3,100 | 2,160 | Succ. | Yes | FW |
| 2,650 | 25 | 175 | 100 | | 51 | 42 | HF | 1,000 | 935 | Succ. | Yes | P (Exp. L) |
| 2,400 | 24.5 | 175 | 95 | HW | 62 | 45 | NC | 1,210 | 1,205 | Succ. | Yes | P (Exp. L) |

Table F

| | Reservoir oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depth, ft** | **Gravity, °API** | **cp** | **°F.** | **Prev. prod.** | **Satur. % start** | **Satur. % end** | **Proj. maturity** | **Total prod., b/d** | **Enh. prod., b/d** | **Proj. eval.** | **Profit** | **Proj. scope** |
| 4,330 | 21 | 12.7 | 120 | Prim./WF | 62 | 43 | Term. | 78 | 21 | Succ. | Yes | P (Exp. L) |
| 4,330 | 21 | 12.7 | 120 | Prim.WF | 53 | 35 | Term. | 52 | 4 | Disc. | No | P (Exp. UL) |
| 3,018 | 26 | 7.81 | 98 | Prim./WF | 51 | 46 | Term. | 84 | 54 | Disc. | No. | |
| 600 | 22 | 100 | 85 | Prim. | | | Term | 1,600 | 1,600 | Succ. | | P |
| 3,140 | 41 | 3 | 110 | WF | 57 | 50 | C | 15 | 5 | Disc. | No | P |
| 1,950 | 27 | 40 | 86 | Prim. | 48 | 23 | C | 118 | 32 | Succ. | No | P (Exp. UL) |
| 1,950 | 27 | 40 | 86 | Prim. | 55 | 30 | C | 144 | 108 | Succ. | Yes | P (Exp. L) |
| 5,200 | 21 | 4.9 | 146 | Prim. | 84 | 69 | Term. | 800 | 800 | Disc. | No | Exp. UL |
| 3,600 | 8.5 | 1,800 | | Prim. | 82 | | C | | | Succ. | Yes | P (Exp. UL) |
| | 16 | | 135 | Prim. | 90 | | Term. | 30 | 20 | Disc. | Exp. UL | |
| 4,325 | | 57 | 137 | | 84 | | Term. | 5,178 | 2,848 | Prom. | Yes | |

## Completed, terminated projects outside U.S. and Canada—continued

| Country | State/area | Operator | Type projects | Field | Start date | Area, acres | No. wells Prod. | No. wells Inj. | Pay zone | Form-ation | Poro-sity, % | Permea-bility, md |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Venezuela | Zulia | Lagoven S.A. | Steam | Cabinas | 8/71 | 96 | 3 | | Lagunillas Inferior | | 31 | 900 |
| Venezuela | Zulia | Lagoven S.A. | Steam | Tia Juana | 7/65 | 2,066 | 17 | | Lagunillas Inferior | S | 36 | 1,064 |
| Venezuela | Anzoategui | Corpoven S.A. | Steam soak | BARE (F.O.) | 9/84 | 1,547 | 7 | 7 | U-1 (YAC.OS-721) | US | 27.9 | 2,000 |
| Venezuela | Anzoategui | Corpoven S.A. | Steam soak | Melones Central | 4/83 | 35,809 | 25 | 26 | U1,2,2(YAC.MEL-15) | US | 34 | 1,500 |
| West Germany | Lower Saxony | Wintershall AG | Hot water | Emlichheim 15 | 1/67 | 115 | 6 | 2 | Valenginian | S | 30 | 6,000 |
| West Germany | | Wintershall AG | Hot water | Ruehlertwist | 12/86 | 53 | 8 | 2 | Valenginian | S | 30 | 400 |
| West Germany | Lower Saxony | Wintershall AG | Hot water | Emlichheim 10 | 11/81 | 41.5 | 3 | 1 | Valenginian | S | 30 | 1,200 |
| West Germany | Northwest | Preussag AG | Polymer | Edesse-Nord | 11/85 | 4.2 | 3 | 2 | Wealden | S | 24 | 6,000 |
| West Germany | | RWE-DEA | Surfactant | Hankensbuettel Westblock | 1/81 | 83 | 7 | 3 | Lower Dogger-Beta | S | 28 | 300-1,000 |

## Producing thermal EOR in U.S.

| Operator | Field | State | County | Start date | Area, acres | – Number wells – Prod. | Inj. | Pay zone | Form-ation type | Poro-sity, % |
|---|---|---|---|---|---|---|---|---|---|---|
| **Steam** | | | | | | | | | | |
| Amoco | Winkleman Dome | Wyo. | Fremont | 1964 | 160 | 19 | 13 | Nugget | S | 22.8 |
| ARCO* | Kern River | Calif. | Kern | 1970 | 80 | 112 | 33 | Kern River series | S | 31.0 |
| ARCO* | Kern River | Calif. | Kern | 1970 | 95 | 71 | 29 | Kern River series | S | 33.0 |
| ARCO* | Kern River | Calif. | Kern | 9/72 | 38 | 32 | 16 | Kern River series | S | 31.0 |
| ARCO* | Kern River | Calif. | Kern | 1972 | 50 | 41 | 20 | Kern River series | S | 31.0 |
| ARCO | Midway-Sunset | Calif. | Kern | 1/72 | 8 | 31 | 4 | Potter | S | 32.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 4/84 | 25 | 24 | 2 | Potter | S | 34.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 1983 | 34 | 13 | 2 | L. Monarch | S | 30.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 3/73 | 29 | 24 | 2 | Potter | S | 34.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 1985 | 22 | 17 | 5 | U. Monarch | S | 29.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 4/85 | 30 | 26 | 5 | Potter | S | 34.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 1973 | 40 | 70 | 10 | Monarch | S | 32.0 |
| ARCO | Midway-Sunset | Calif. | Kern | 6/89 | 24 | 42 | 6 | Potter | S | 34.0 |
| ARCO | Midway-Sunset | Calif. | Kern | 8/72 | 9 | 35 | 4 | Monarch | S | 32.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 1984 | 15 | 12 | 0 | Sub Lakeview | S | 30.0 |
| ARCO* | Midway-Sunset | Calif. | Kern | 1969 | 50 | 60 | 15 | Metson | S | 30.0 |
| ARCO | Midway-Sunset | Calif. | Kern | 2/72 | 200 | 50 | 3 | Potter | S | 32.0 |
| ARCO | Midway-Sunset | Calif. | Kern | 12/84 | 160 | 12 | 0 | MYA TAR | S | 32.0 |
| ARCO* | Placerita | Calif. | Los Angeles | 1986 | 95 | 70 | 17 | L. Kraft | S | 28.0 |
| Bechtel | Elk Hills | Calif. | Kern | 7/87 | 20 | 9 | 4 | Sub-Scalez, Shallow oil zone | US | 30.0 |
| Chevron | Cymric 26W | Calif. | Kern | 10/89 | 30 | 31 | 19 | Tulare | S | 33.0 |
| Chevron | Cymric 36W | Calif. | Kern | 5/75 | 110 | 98 | 47 | Tulare/Amnicola | S | 33.0 |
| Chevron | Cymric 6Z | Calif. | Kern | 2/86 | 30 | 31 | 19 | Tulare | S | 33.0 |
| Chevron | Cymric Sec. 31X | Calif. | Kern | 4/79 | 69 | 38 | 17 | Amnicola | S | 35.0 |
| Chevron | Edison 27-RT | Calif. | Kern | 7/77 | 30 | 65 | 29 | Kern River | S | 30.0 |
| Chevron | Kern River KCL 39 | Calif. | Kern | 10/75 | 118 | 67 | 42 | Kern River | S | 33.0 |
| Chevron | Kern River MCCII | Calif. | Kern | 4/71 | 80 | 129 | 30 | Kern River | S | 34.0 |
| Chevron | Kern River Sec. 3 | Calif. | Kern | 9/68 | 424 | 345 | 155 | Kern River | S | 34.0 |
| Chevron | Kern River Sec. 4 | Calif. | Kern | 6/78 | 156 | 200 | 64 | Kern River | S | 34.0 |
| Chevron | Kern River MC1 | Calif. | Kern | 4/76 | 132 | 120 | 76 | Kern River | S | 34.0 |
| Chevron | Kern River—ANO | Calif. | Kern | 5/74 | 160 | 177 | 82 | Kern River | S | 32.0 |
| Chevron | Lost Hills Sec. 18 | Calif. | Kern | 7/83 | 38 | 39 | 11 | Tulare | S | 38.0 |
| Chevron | Lost Hills Sec. 18 | Calif. | Kern | 8/85 | 14 | 8 | 0 | Tulare | S | 38.0 |
| Chevron | Lost Hills Sec. 30 | Calif. | Kern | 1/80 | 190 | 37 | 0 | Etchegoin A | S | 40.0 |
| Chevron | McKittrick | Calif. | Kern | 6/77 | 131 | 37 | 15 | Amnicola | S | 37.0 |
| Chevron | McKittrick | Calif. | Kern | 8/83 | 17 | 21 | 8 | Tulare | S | 36.0 |
| Chevron | McKittrick | Calif. | Kern | 6/87 | 70 | 25 | 14 | Amnicola | S | 37.0 |
| Chevron | McKittrick 6Z | Calif. | | 4/85 | 30 | 29 | 18 | Tulare/Amnicola | S | 36.0 |
| Chevron | McKittrick 9Z | Calif. | Kern | 8/78 | 80 | 27 | 11 | Amnicola | S | 38.0 |
| Chevron | Midway-Sunset Sec. 15A | Calif. | Kern | 5/78 | 23 | 36 | 5 | Potter | S | 36.0 |
| Chevron | Midway-Sunset Sec. 25A | Calif. | Kern | 6/87 | 35 | 14 | 4 | Tulare | S | 35.0 |
| Chevron | Midway-Sunset Sec. 26C | Calif. | Kern | 11/75 | 84 | 243 | 81 | Monarch | S | 32.0 |
| Chevron | Midway-Sunset Sec. 2F | Calif. | Kern | 10/83 | 84 | 44 | 10 | Webster | S | 32.0 |
| Chevron | NE. McKittrick 16-Z | Calif. | Kern | 9/75 | 87 | 42 | 27 | Amnicola | S | 35.0 |
| Chevron | West Coalinga | Calif. | Fresno | 3/89 | 100 | 70 | 21 | Temblor | S | 33.0 |
| Chevron | West Coalinga | Calif. | Fresno | 7/84 | 60 | 40 | 12 | Temblor | S | 33.0 |
| Chevron | West Coalinga | Calif. | Fresno | 2/82 | 43 | 38 | 10 | Temblor | S | 33.0 |
| Chevron | West Coalinga 13-D | Calif. | Fresno | 5/73 | 550 | 182 | 104 | Temblor | S | 35.0 |
| Chevron | West Coalinga 25-D | Calif. | Kern | 5/80 | 36 | 131 | 95 | Temblor | S | 29.0 |
| Enercap Corp. | Camp Hill | Tex. | Anderson | 4/89 | 25 | 23 | 14 | Carrizo | S | 37.0 |
| Exxon | Edison | Calif. | Kern | 1965 | 1,100 | | | Kern River | S | 28.0 |
| Exxon† | Midway-Sunset | Calif. | Kern | | 200 | 100 | 100 | Monarch Sand | S | 30.0 |
| Exxon† | South Belridge | Calif. | Kern | | 90 | 41 | 30 | Tulare | S | 38.0 |
| John Brown E & Co | Teapot Dome NPR-3 | Wyo. | Natrona | 10/85 | 120 | 68 | 22 | Shannon | S | 18.0 |
| M.H. Whitter | Midway-Sunset | Calif. | Kern | 1965 | 200 | 336 | | Potter | US | 35.0 |
| MacPherson Oil Co. | Mt. Poso -West area | Calif. | Kern | 5/89 | 240 | 40 | 3 | Vedder | US | 35.0 |
| Marathon Oil | Garland | Wyo. | Big Horn | 5/86 | 35 | 6 | 1 | Madison | LS | 15.5 |
| Mobil | Bayou Bleu | La. | Iberville | 5/88 | 120 | 26 | 7 | E.B. Schwing RA SUA | S | 30.0 |
| Mobil | Cymric McKittrick Fee | Calif. | Kern | 7/65 | 180 | 40 | 0 | Welport Amnicola | S | 35.0 |
| Mobil | Midway-Sunset | Calif. | Kern | 10/70 | 400 | 280 | 0 | Monarch | S | 34.0 |
| Mobil | North Midway-Sunset | Calif. | Kern | 11/67 | 410 | 372 | | Potter | S | 35.0 |
| Mobil | San Ardo | Calif. | Monterey | 6/68 | 312 | 78 | 16 | Aurignac | S | 34.5 |
| Mobil | San Ardo | Calif. | Monterey | 3/80 | 84 | 38 | 12 | Lombardi | S | 32.5 |
| Mobil | Saratoga | Tex. | Hardin | 6/87 | 54 | 10 | 5 | Miocene | S | 35.0 |
| Mobil | Sho-Vel-Tum | Okla. | Carter | 11/86 | 55 | 7 | 7 | Deese Sand | S | 26.5 |
| Mobil | South Belridge | Calif. | Kern | 1969 | 870 | 446 | 147 | Tulare | US | 36.8 |
| Mobil | South Belridge | Calif. | Kern | 1965 | 1,987 | 50 | | Tulare | US | 36.8 |
| Oryx | Cymric | Calif. | Kern | 1981 | 135 | 55 | 3 | Tulare | S | 35.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 7/84 | 49 | 76 | 0 | Potter | S | 28.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 3/64 | 106 | 225 | 14 | Potter/Tulare | S | 35.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 1/84 | | 153 | 0 | Potter | S | 35.0 |

Table F

| Depth, ft | Reservoir oil |  |  | Prev. prod. | Satur. % start | Satur. % end | Proj. maturity | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Proj. scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gravity, °API | cp | °F. |  |  |  |  |  |  |  |  |  |
| 1,985 | 16 | 15 | 135 |  | 80 |  | Term. | 138 | 80 | Disc. | P (Exp. UL) |  |
| 2,100 | 14 | 93 | 118 | Prim. | 70 |  | Term. | 646 | 628 | Prom. | Yes | P (Exp. UL) |
| 3,400 | 9.8 | 232 | 145 | Prim. | 78.8 | 70 | C | 1,195 | 540 | Prom. | Yes | RW (Exp. UL) |
| 3,800 | 11.5 | 200 | 160 | Prim. | 78 | 63 | C | 3,955 | 2,150 | Succ. | Yes | P (Exp. L) |
| 2,300 | 24.5 | 175 | 95 | WF | 72 | 54 | C | 100 | 100 | Succ. | Yes | FW |
| 2,460 | 25 | 175 |  | WF | 76 | 74 | C | 60 | 45 | Disc. | No | P (Exp. L) |
| 2,460 | 24.5 | 175 | 95 | WF | 70 | 68 | C | 25 | 20 | Disc. | No | FW |
| 1,200 | 36 | 8 | 73 | WF | 53 | 37 | C | 20 | 12 | Succ. | No | P (Exp. L) |
| 4,900 | 27 | 11 | 136 | WF | 58 | 39 | Term. | 0 | 0 | Disc. | No | Exp. UL |

Table G

| Permeability, md | Depth, ft | Reservoir oil |  |  | Prev. prod. | Satur. % start | Satur. % end | Proj. matur. | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Proj. scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | Gravity, °API | cp | °F. |  |  |  |  |  |  |  |  |  |
| 481 | 1,225 | 14.0 | 1,000 | 81 | Prim. | 71 |  | NC | 215 | 215 | Succ. |  | FW |
| 2,000 | 600 | 13.0 | 5,000 | 78 | Prim. | 63 | 15.0 | NC | 600 | 600 | Succ. | Yes | FW |
| 4,000 | 1,200 | 13.0 | 8,000 | 90 | SS | 55 | 20.0 | NC | 1,030 | 950 | Succ. | Yes | FW |
| 2,500 | 900 | 13.0 | 7,000 | 84 | Prim. | 70 | 15.0 | HF | 480 | 480 | Succ. | Yes | FW |
| 2,000 | 800 | 13.0 | 8,000 | 90 | SS | 60 | 15.0 | NC | 1,100 | 1,100 | Succ. | Yes | FW |
| 1,675 | 1,200 | 12.0 | 2,000 | 100 | SS | 65 | 15.0 | HF | 450 | 350 | Succ. | Yes | LW |
| 4,000 | 1,600 | 11.5 | 10,000 | 95 | SS | 67 | 15.0 | HF | 700 | 500 | Succ. | Yes | LW |
| 2,000 | 1,500 | 13.0 | 5,000 | 10 | C | 60 | 30.0 | HF | 300 | 200 | Succ. | Yes | FW |
| 4,100 | 1,600 | 11.5 | 7,000 | 95 | SS | 65 | 15.0 | NC | 950 | 900 | Succ. | Yes | LW |
| 2,000 | 1,300 | 13.0 | 5,000 | 100 | SS | 60 | 18.0 | JS | 600 | 500 | Succ. | Yes | Exp. L |
| 3,700 | 1,500 | 11.5 | 10,000 | 95 | SS | 62 | 15.0 | HF | 1,200 | 1,000 | Succ. | Yes | LW |
| 1,500 | 1,200 | 13.0 | 3,000 | 200 | SS | 50 | 10.0 | HF | 2,300 | 1,400 | Succ. | Yes | LW |
| 2,854 | 1,850 | 11.5 | 10,000 | 95 | SS | 65 | 15.0 | JS | 500 | 50 | TETT |  | LW |
| 1,500 | 1,000 | 13.0 | 1,500 | 100 | SS | 50 | 10.0 | JS | 320 | 75 | Succ. | Yes | RW |
| 4,500 | 1,300 | 13.0 | 4,000 | 90 | Prim. | 60 | 35.0 | HF | 120 | 100 | Succ. | Yes | FW |
| 3,000 | 1,100 | 11.4 | 9,500 | 130 | Prim. | 75 | 57.0 | JS | 800 | 250 | TETT |  | Exp. L |
| 2,500 | 1,200 | 14.0 | 1,500 | 100 | Prim. | 65 |  | NC | 1,150 |  | Succ. | Yes | FW |
| 3,030 | 1,050 | 14.0 | 1,500 | 95 | Prim. | 65 |  | NC | 70 |  | Disc. | No. | P (Exp. L) |
| 3,000 | 1,800 | 12.0 | 7,500 | 100 | Prim. | 62 | 15.0 | JS | 1,200 | 700 | Prom. |  | FW |
| 500 | 2,800 | 27.0 | 6 | 120 | Prim. | 55 | 5.0 | HF | 350 | 50 | TETT |  | P |
| 2,900 | 1,200 | 12.0 | 5,500 | 100 | C | 51 | 15.0 | JS | 1,850 | 1,650 | Succ. | Yes | P |
| 1,800 | 1,200 | 13.0 | 4,000 | 100 |  | 52 |  | NC | 3,800 | 3,800 | Succ. | Yes | FW |
| 2,900 | 1,200 | 12.0 | 5,500 | 100 | C | 51 | 15.0 | JS | 2,500 | 2,400 | Succ. | Yes | Exp. L |
| 2,700 | 1,300 | 12.0 | 3,000 | 100 | Prim. | 50 |  | NC | 1,600 | 1,600 | Succ. | Yes | FW |
|  | 1,000 | 14.0 | 2,000 | 90 | Prim. | 50 |  | NC | 1,600 | 1,600 | Succ. | Yes | FW |
|  | 1,400 | 14.0 | 2,000 | 90 |  | 65 |  | HF | 600 | 600 | Succ. | Yes | FW |
| 2,800 | 960 | 14.0 | 2,000 | 90 | Prim. | 59 |  | HF | 1,950 | 1,950 | Succ. | Yes | FW |
| 3,389 | 775 | 14.0 | 2,000 | 90 | Prim. | 55 |  | HF | 8,700 | 8,700 | Succ. | Yes | FW |
|  | 850 | 14.0 | 2,000 | 90 |  | 60 |  | HF | 3,100 | 3,100 | Succ. | Yes | FW |
| 2,800 | 960 | 14.0 | 2,000 | 90 |  | 59 |  | HF | 3,900 | 3,900 | Succ. | Yes | FW |
|  | 1,000 | 14.0 | 2,000 | 90 | Prim. | 55 |  | HF | 4,800 | 4,800 | Succ. | Yes | FW |
| 2,100 | 300 | 14.0 | 400 | 75 | C | 88 |  | JS | 410 | 410 | Succ. | Yes | P (Exp. L) |
| 2,000 | 350 | 12.0 | 4,600 | 90 | C | 55 | 20.0 | JS | 20 | 20 | Disc. | No | P (Exp. UL) |
| 800 | 550 | 18.0 | 300 | 90 | Prim. |  |  | HF | 280 | 280 | Prom |  |  |
| 1,000-2,000 | 1,100 | 11.3 | 500 | 170 | SS | 60 | 36.0 | NC | 610 | 425 | Succ. | Yes |  |
| 1,000-2,000 | 850 | 11.4 | 1,000 | 140 | SS | 60 | 27.0 | NC | 650 | 545 | Succ. | Yes |  |
| 1,500 | 1,100 | 12.0 | 300 |  | SF | 41 | 31.0 | JS | 290 |  | TETT |  | FW |
| 2,900 | 1,300 | 13.0 | 2,700 | 100 | C | 48 | 15.0 | JS | 2,600 | 1,250 | Prom. | Yes | P |
| 2,700 | 1,300 | 13.0 | 4,000 | 100 | C | 47 |  | HF | 410 | 410 | Succ. | Yes | FW |
| 3,900 | 1,400 | 14.0 | 900 | 120 | C | 61 | 20.0 | NC | 2,650 | 2,650 | Succ. | Yes | P |
| 1,000 | 1,000 | 11.0 | 10,000 | 90 | C | 53 |  | JS | 400 | 400 | TETT |  | P |
| 1,100 | 1,300 | 14.0 | 1,500 | 150 | C | 58 | 20.0 | HF | 7,900 | 7,900 | Succ. | Yes | FW |
| 2,000 | 1,800 | 12.0 | 7,000 | 90 |  | 60 |  | HF | 2,300 | 2,300 | Succ. |  | RW |
| 2,700 | 1,300 | 12.0 | 4,000 | 100 | C | 57 |  | HF | 510 | 510 | Succ. | Yes | FW |
| 2,300 | 1,700 | 13.0 | 6,000 | 100 | C | 44 | 15.0 | JS | 1,800 | 300 | TETT |  | P |
| 2,400 | 1,500 | 13.0 | 5,700 | 100 | C | 49 | 15.0 | HF | 1,200 | 1,200 | Succ. | Yes | LW |
| 2,400 | 1,600 | 13.0 | 6,000 | 100 | C | 50 | 15.0 | HF | 800 | 800 | Succ. | Yes | LW |
| 1,000 | 1,200 | 13.0 | 1,000 | 90 | Prim. | 46 | 15.0 | NC | 3,400 | 3,400 | Succ. | Yes | FW |
| 1,000 | 2,500 | 12.0 | 2,300 | 100 | Prim. | 50 | 12.0 | HF | 5,800 | 5,800 | Succ. | Yes | FW |
| 2,500 | 400 | 18.4 | 1,200 | 75 | Prim. | 50 |  | JS | 300 | 300 | Succ. | Yes | LW |
| 1,100 | 1,100 | 12.0 | 8,000 | 95.0 | Prim. |  |  | HF | 450 | 450 | Succ. | Yes |  |
| 2,500 | 1,500 | 12.0 | 11,000 | 95 |  |  |  |  | 600 | 600 | Succ. | Yes | FW |
| 4,000 | 1,250 | 13.0 | 450 |  |  |  |  |  | 1,500 | 1,500 | Succ. | Yes | FW |
| 63 | 325 | 33.0 | 10.00 | 65 | Prim. | 50 | 15.0 | NC | 775 | 734 | Succ. | Yes | RW (Exp. L) |
| 2,500 | 1,000-1,500 | 13.0 | 2,200 | 100 | Prim. | 60 | 30.0 | HF | 5,100 | 5,100 | Succ. | Yes | FW |
| 2,000 | 2,500 | 17.0 | 350 | 105 | Prim. | 50 | 20.0 | JS | 220 | 100 | TETT |  | LW (Exp. L) |
| 10 | 4,250 | 22.0 | 29 | 140 | Prim. |  |  | NC | 396 | 65 | Disc. | No | P (Exp. L) |
| 2,000-4,000 | 1,550 | 16.0 | 30 | 100 | Prim. | 70 |  | JS | 500 | 400 | TETT |  | RW |
| 3,000 | 500 | 13.0 | 1,500 | 95 | Prim. | 87.5 | 57.7 | NC | 300 | 300 | Succ. | Yes | FW |
| 4,000 | 950 | 13.0 | 800 | 85 | Prim. | 64 | 53.0 | HF | 1,600 | 1,600 | Succ. | Yes | FW |
| 1,000 | 1,000 | 12.0 | 2,000 | 100 | Prim. | 65 | 30.0 | HF | 5,200 | 5,200 | Succ. | Yes | FW |
| 3,000 | 2,300 | 12.0 | 300 | 130 | SS | 55 | 27.0 | HF | 1,628 | 1,628 | Succ. | Yes | FW |
| 5,000 | 2,100 | 11.0 | 3,000 | 125 | SS | 55 | 27.0 | HF | 3,129 | 3,129 | Succ. | Yes | P (Exp. L) |
| 3,000 | 500 | 15.0 | 500 | 74 | Prim. | 50 | 20.0 | JS | 380 | 380 | Prom. | Yes | Exp. L |
| 875 | 1,500 | 16.0 | 939 | 85 | WF | 80 |  | JS | 200 | 200 | Prom. |  | P |
| 3,000 | 1,000 | 14.0 | 1,600 | 95 | SS | 55.7 | 18.1 | HF | 33,500 | 33,500 | Succ. | Yes | Exp. L |
| 3,000 | 1,000 | 14.0 | 1,600 | 95 | Prim. | 57 | 53.6 | NC | 800 | 800 | Succ. | Yes | Exp. L |
| 1,500 | 600-1,500 | 12.0 |  | 95 | Prim. |  |  | HF | 1,016 | 1,016 | Succ. | Yes | FW |
| 3,000 |  | 12.0 | 2,300 | 80 | Prim. | 80 | 40.0 | HF | 648 | 648 | Succ. | Yes | FW |
| 3,000 | 1,200 | 12.0 |  |  | Prim. |  |  | HF | 7,036 | 7,036 | Succ. | Yes | FW |
| 3,000 | 1,100 | 11.0 |  |  | Prim. |  |  | HF | 2,203 | 2,203 | Succ. | Yes | FW |

## *Producing thermal EOR in U.S.—continued*

| Operator | Field | State | County | Start date | Area, acres | – Number wells – Prod. | Inj. | Pay zone | Formation type | Porosity, % |
|---|---|---|---|---|---|---|---|---|---|---|
| Oryx | Midway-Sunset | Calif. | Kern | 1/84 | 80 | 106 | 12 | Potter/Marvic/Tulare | US | 35.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 7/84 | 70 | 56 | 6 | Potter | US | 35.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 8/65 | 80 | 195 | 0 | Potter | US | 30.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 7/84 | 120 | 271 | 0 | Potter | US | 30.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 2/88 | 90 | 18 | 4 | Marvic | US | 34.0 |
| Oryx | Midway-Sunset | Calif. | Kern | 5/64 | 80 | 220 | 0 | Potter | S | 35.0 |
| Oxy USA | Kern Front | Calif. | Kern | 11/81 | 342 | 120 | 8 | Etchegoin Chanac | S | 33.0 |
| Phillips | Smackover | Ark. | Ouachita | 10/71 | 985 | 91 | 5 | Nachatoch | S | 35.0 |
| Santa Fe Energy | Coalinga | Calif. | Fresno | 3/79 | 160 | 142 | 54 | Lower Temblor | S | 30.0 |
| Santa Fe Energy | Coalinga | Calif. | Fresno | 10/89 | 20 | 14 | 6 | Lower Temblor | S | 30.0 |
| Santa Fe Energy | Coalinga | Calif. | Fresno | 10/89 | 20 | 23 | 4 | Upper Temblor | S | 30.0 |
| Santa Fe Energy | Kern River | Calif. | Kern | 9/89 | 20 | 31 | 8 | Kern River Series | S | 30.0 |
| Santa Fe Energy | Midway | Calif. | Kern | 1/85 | 100 | 160 | 25 | Potter S.D. | S | 30.0 |
| Santa Fe Energy | Midway | Calif. | Kern | 1964 | 900 | 1,000 | | Potter Cyc. | S | 30.0 |
| Santa Fe Energy | Midway | Calif. | Kern | 1970 | 400 | 460 | | Spellacy | S | 30.0 |
| Santa Fe Energy | Midway | Calif. | Kern | 6/82 | 800 | 240 | | Tulare | S | 33.0 |
| Shell | Arroyo Grande | Calif. | San Luis Obispo | 1/87 | 20 | 35 | 13 | M6 | S | 31.0 |
| Shell | Belridge | Calif. | Kern | 1961 | 3,489 | 2,982 | 683 | Tulare | S | 36.0 |
| Shell | Cat Canyon | Calif. | Santa Barbara | 3/85 | 1,000 | | | Basal Sisquoc | S | 32.0 |
| Shell | Coalinga | Calif. | Fresno | 1981 | 700 | 150 | 29 | Temblor Zone II | S | 30.0 |
| Shell | Coalinga | Calif. | Fresno | 1980 | 550 | 196 | 39 | Temblor Zone I | S | 32.0 |
| Shell | Coalinga | Calif. | Fresno | 1984 | 300 | 60 | 8 | Temblor Zone II | S | 27.0 |
| Shell | Coalinga | Calif. | Fresno | 11/87 | 245 | 80 | 30 | Etchegoin | S | 34.0 |
| Shell | Cymric | Calif. | Kern | 12/86 | 200 | 124 | 27 | Tulare | S | 36.0 |
| Shell | Kern River | Calif. | Kern | 1970 | 600 | 1,100 | 225 | Kern River Series | S | 30.0 |
| Shell | Kern River | Calif. | Kern | 9/83 | 85 | 35 | 35 | Kern River | S | 31.0 |
| Shell | McKittrick | Calif. | Kern | 3/88 | 226 | 114 | 30 | Tulare | S | 36.0 |
| Shell | Midway-Sunset | Calif. | Kern | 1/89 | 5 | 8 | 2 | San Joaquin | S | 33.0 |
| Shell | Midway-Sunset | Calif. | Kern | 1979 | 95 | 73 | 0 | Upper Spellacy | S | 28.0 |
| Shell | Midway-Sunset | Calif. | Kern | 1/89 | 68 | 76 | 10 | Lower | S | 25.0 |
| Shell | Midway-Sunset | Calif. | Kern | 1983 | 143 | 205 | 27 | Sub-Hoyt | S | 31.0 |
| Shell | Midway-Sunset | Calif. | Kern | 1971 | 400 | 575 | 35 | Potter | US | 22-32 |
| Shell | Midway-Sunset | Calif. | Kern | 1980 | 85 | 130 | 15 | Monarch | S | 25.0 |
| Shell | Mount Poso | Calif. | Kern | 1971 | 2,800 | 253 | 46 | Vedder | S | 33.0 |
| Shell | Poso Creek | Calif. | Kern | 6/80 | 360 | 70 | 0 | Etchegoin | S | 33.0 |
| Shell | White Castle | La. | Iberville | 8/76 | 64 | 30 | 10 | V | S | 35.0 |
| Shell | White Castle | La. | Iberville | 8/76 | 31 | 12 | 3 | U | S | 35.0 |
| Shell§ | Yorba Linda | Calif. | Kern | 7/62 | 80 | 76 | 0 | Shallow Tar | S | 27.0 |
| Shell | Yorba Linda | Calif. | Orange | 1971 | 310 | 300 | 16 | Upper Congolomerate | S | 22.0 |
| Texaco | Cat Canyon | Calif. | Santa Barbara | 1964 | 1,700 | 12 | | S1B | S | 31.0 |
| Texaco | Cat Canyon | Calif. | Santa Barbara | 1977 | 390 | 91 | | S1A-S6 | S | 31.0 |
| Texaco | Kern River | Calif. | Kern | 8/62 | 5,070 | 4,324 | 1,642 | Kern River Series | S | 31.0 |
| Texaco | Lost Hills | Calif. | Kern | 1977 | 35 | 46 | 11 | Etchegoin | S | 40.0 |
| Texaco | Lost Hills | Calif. | Kern | 1977 | 49 | 33 | 17 | Tulare | S | 38.0 |
| Texaco | McKittrick | Calif. | Kern | 1984 | 18 | 15 | 6 | Tulare | S | 35.0 |
| Texaco | Midway-Sec 35 | Calif. | Kern | 1977 | 27 | 51 | 7 | Potter | US | 35.0 |
| Texaco | Midway-Sec 36 | Calif. | Kern | 1/89 | 38 | 62 | 11 | Potter | US | 36.0 |
| Texaco | Midway-North Midway | Calif. | Kern | 11/81 | 77 | 100 | 23 | Potter | US | 30.0 |
| Texaco | Midway-Sec 35 | Calif. | Kern | 1984 | 22 | 34 | 5 | Potter | US | 35.0 |
| Texaco | Midway-Security | Calif. | Kern | 11/77 | 36 | 72 | 15 | Potter | US | 33.0 |
| Texaco | San Ardo | Calif. | Monterey | 7/87 | 51 | 24 | 7 | Lombardi | S | 32.0 |
| Texaco | San Ardo | Calif. | Monterey | 1965 | 1,108 | 53 | 0 | Aurignac | S | 39.0 |
| Texaco | Sour Lake | Tex. | Hardin | 11/81 | 26 | 18 | 3 | Miocene OB-1 | S | 35.5 |
| Texaco | Sour Lake | Tex. | Hardin | 6/84 | 7 | 3 | 2 | Miocene OB-4 | S | 35.0 |
| Texaco | Sour Lake | Tex. | Hardin | 3/85 | 9 | 2 | 1 | Miocene OB-2 | S | 33.3 |
| Texaco | Sour Lake | Tex. | Hardin | 1/86 | 6 | 4 | 2 | Miocene OB-2 | S | 33.0 |
| Texaco | Sour Lake | Tex. | Hardin | 7/89 | 74 | 13 | 2 | Miocene OB-3 | S | 33.0 |
| Texaco | Sour Lake | Tex. | Hardin | 10/87 | 4 | 6 | 2 | Miocene 700 ft | S | 33.0 |
| Union Pacific | Wilmington | Calif. | Los Angeles | 4/89 | 85 | 38 | 27 | Tar | S | 30.0 |
| Unocal | Cymric | Calif. | Kern | 1964 | 300 | 259 | 0 | Tulare | S | 35.0 |
| Unocal | Guadalupe | Calif. | San Luis | 1955 | 2,970 | 150 | 0 | Sisquoc | S | 35.0 |
| Unocal | Midway-Sunset | Calif. | Kern | 1974 | 81 | 57 | 17 | Potter | S | 34.5 |
| Unocal | Midway-Sunset | Calif. | Kern | 1983 | 81 | 61 | 0 | Tulare | S | 31.0 |
| Unocal | Midway-Sunset | Calif. | Kern | 6/77 | 39 | 60 | 17 | Potter | S | 24.0 |
| Unocal | Midway-Sunset | Calif. | Kern | 5/69 | 161 | 173 | 0 | Potter | S | 24.0 |
| Unocal | North Belridge | Calif. | Kern | 11/65 | 160 | 14 | 0 | Tulare | S | 38.0 |
| Unocal | Tensleep | Wyo. | Natrona | 5/81 | 25 | 9 | 2 | Tensleep | S | 18.0 |
| **Hot water** | | | | | | | | | | |
| ARCO* | Kern River | Calif. | Bakersfield | 1986 | 50 | 45 | 10 | Kern River Series | S | 31.0 |
| ARCO* | Kern River | Calif. | Bakersfield | 1986 | 28 | 42 | 11 | Kern River Series | S | 31.0 |
| ARCO | Midway-Sunset | Calif. | Kern | 8/85 | 6 | 6 | 2 | Tulare | S | 33.0 |
| Mobil | South Belridge | Calif. | Kern | 11/82 | 242 | 54 | 8 | Tulare | US | 36.8 |
| Santa Fe Energy | Kern River | Calif. | Kern | 1/80 | 150 | 101 | 57 | Kern River | S | 30.0 |
| Texaco | Lost Hills | Calif. | Kern | 1/86 | 11 | 13 | 4 | Tulare | S | 38.0 |
| Texaco | Lost Hills | Calif. | Kern | 1/86 | 38 | 31 | 13 | Etchegoin | S | 40.0 |
| Texaco | McKittrick | Calif. | Kern | 1981 | 12 | 50 | 14 | Potter | S | 35.0 |
| Texaco | San Ardo | Calif. | Monterey | 9/86 | 240 | 62 | 24 | Aurignac | S | 33.0 |
| **Combustion** | | | | | | | | | | |
| Bayou State | Bellevue | La. | Bossier | 1970 | 200 | 85 | 15 | Nacatoch | S | 32.0 |
| Chevron | W. Heidelberg | Miss. | Jasper | 12/71 | 362 | 9 | 3 | Cotton Valley 4 & 5 | S | 14.0 |
| Greenwich Oil | Forest Hill | Tex. | Wood | 9/76 | 1,900 | 100 | 21 | Harris Sand | S | 28.0 |
| Mobil | Lost Hills | Calif. | Kern | 4/61 | 164 | 45 | 7 | Tulare | S | 42.6 |
| Mobil | Midway-Sunset | Calif. | Kern | 1/60 | 150 | 32 | 6 | Moco | S | 36.0 |
| Mobil | West Newport | Calif. | Orange | 1938 | 300 | 139 | 33 | Miocene | S | 37.0 |
| Santa Fe Energy | Midway-Sunset | Calif. | Kern | 1982 | 24 | 40 | 10 | Potter | S | 32.5 |
| Texaco | Bellevue | La. | Bossier | 9/63 | 385 | 200 | 30 | Nacatoch | S | 33.0 |

| Permeability, md | Depth, ft | Reservoir oil | | | Prev. prod. | Satur. % start | Satur. % end | Proj. matur. | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Proj. scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Gravity, °API | cp | °F. | | | | | | | | | |
| 3,000 | 1,100 | 11.0 | 2,300 | 95 | Prim. | | | HF | 914 | 914 | Succ. | Yes | FW |
| 3,000 | | 12.0 | 2,300 | 95 | Prim. | | | HF | 603 | 603 | Succ. | Yes | FW |
| 3,000 | 600 | 12.0 | 3,607 | 110 | Prim. | 80 | 20.0 | HF | 4,657 | 4,657 | Succ. | Yes | FW |
| 3,000 | 700 | 12.0 | 3,607 | 110 | Prim. | 80 | 80.0 | HF | 5,613 | 5,613 | Succ. | Yes | FW |
| 1,000 | 1,200 | 13.0 | 3,000 | 104 | S | 70 | 15.0 | JS | 245 | 245 | TETT | | P |
| 3,000 | 1,200 | 12.0 | | | Prim. | | | HF | 3,734 | 3,734 | Succ. | Yes | FW |
| 3,250 | 1,300-1,500 | 14.0 | 1,525 | 95 | Prim. | 50 | 15.0 | JS | 1,400 | 1,400 | TETT | Yes | FW |
| 2,000 | 1,920 | 20.0 | 75 | 110 | Prim. | 71 | 50.0 | NC | 600 | | Succ. | Yes | FW |
| 100-3,000 | 850-1,800 | 14.5 | 1,900 | 75 | Prim. | 35 | 15.0 | NC | 1,800 | 1,500 | Succ. | Yes | FW |
| 100-3,000 | 600-1,300 | 14.5 | 1,900 | 75 | Prim. | 40 | 15.0 | JS | 75 | 65 | TETT | | Exp. L |
| 100-3,000 | 1,100-1,600 | 14.5 | 1,900 | 75 | Prim. | 40 | 15.0 | JS | 100 | 85 | TETT | | Exp. L |
| 100-3,000 | 300-600 | 13.0 | 4,000 | 85 | Prim. | 45 | 15.0 | JS | 250 | 200 | TETT | | EXP. L |
| 2,500 | 1,300 | 12.0 | 4,000 | 100 | Prim./C | 60 | 20.0 | | 3,200 | 1,500 | TETT | | Exp. L |
| 2,500 | 1,300 | 12.0 | 4,000 | 100 | Prim. | 60 | 33.0 | | 15,200 | 13,400 | Succ. | Yes | FW |
| 2,250 | 900 | 11.5 | 6,500 | 90 | Prim. | 60 | 33.0 | | 4,200 | 3,300 | Succ. | Yes | FW |
| 1,300 | 1,200 | 11.0 | 5,000 | 100 | Prim. | 50 | 43.0 | | 1,200 | 700 | Succ. | Yes | FW |
| 500-800 | 200-2,000 | 13-15 | 2,500-3,000 | 80-100 | Prim. | 56 | | JS | 700 | 550 | Prom. | Yes | FW |
| 2,400 | 400-1,400 | 13.0 | 1,900 | 95 | Prim. | | | HF | 88,831 | 88,831 | Succ. | Yes | FW |
| 500-1,000 | 2,500-4,500 | 8-12 | | 90-150 | Prim. | 55 | | PP | | | Succ. | Yes | FW |
| 100-500 | 1,400-1,800 | 15-20 | 100-300 | 80-120 | SS | | | NC | 1,300 | 1,300 | Succ. | Yes | FW |
| 200-2,500 | 825-1,650 | 11-14 | 2,000-10,000 | 84-98 | Prim. | 60 | 10.0 | HF | 3,200 | 3,100 | Succ. | Yes | FW |
| 100-500 | 1,500-2,000 | 15-20 | 100-300 | 80-120 | Prim | | | JS | 900 | 720 | Succ. | Yes | P (Exp. L) |
| 800-1,000 | 650-1,000 | 7-12 | | 80-90 | Prim. | 55 | | JS | 3,300 | 3,300 | Succ. | | FW |
| 1,000-2,000 | 1,000 | 11-14 | 1,000-2,000 | 95-105 | Prim. | | | JS | 2,700 | 2,700 | Prom. | | LW |
| 500-2,500 | 150-1,500 | 11-15 | | 78-85 | Prim. | | | HF | 12,200 | 11,840 | Succ. | Yes | FW |
| 2,000 | 1,200 | 12.0 | | 81 | Prim. | 55 | | PP | 400 | 400 | TETT | | LW |
| 1,000-2,000 | 600 | 10-12 | | 90-100 | Prim. | | | JS | 100 | 100 | TETT | | LW |
| | 1,200 | 12.0 | 2,900 | 95 | SS | | | JS | | | TETT | | LW |
| | 900 | 13.0 | 2,235 | 90 | Prim. | | | HF | 1,050 | 950 | Succ. | Yes | FW |
| | 800 | 11.6 | 5,000 | 90 | | | | JS | 850 | 750 | Prom. | | LW |
| 2,000-3,000 | 1,080 | 13.0 | 3,000 | 100 | Prim. | | | HF | 6,000 | 5,800 | Succ. | Yes | FW |
| | 500-1,400 | 8.5-14 | | 95 | Prim. | | | HF | 11,400 | 11,400 | Succ. | Yes | FW |
| 900 | 1,300 | 13.0 | 2,700 | 95 | SS | | | HF | 6,400 | 6,300 | Succ. | Yes | FW |
| 2,000-10,000 | 1,800-2,000 | 15-18 | 100-500 | 90-130 | Prim. | 55 | 10 | NC | 14,800 | 14,800 | Succ. | Yes | FW |
| 2,000-4,000 | 2,300-2,600 | 10-14 | 400-800 | 80-90 | Prim | | | JS | 800 | 500 | Succ. | Yes | FW |
| 3,000 | 1,400 | 16.0 | 312 | 92 | Prim. | 90 | | HF | 1,490 | 1,490 | Succ. | Yes | RW |
| 3,000 | 1,100 | 16.0 | 145 | 88 | Prim | 90 | | HF | 210 | 210 | Succ. | Yes | RW |
| 1,000 | 250-1,650 | 13.0 | | 97 | Prim. | 95 | | NC | 600 | 100 | Succ. | Yes | FW |
| 500-3,000 | 500-1,000 | 10-14 | | 70-100 | SS | 66 | | NC | 2,300 | 2,300 | Succ. | Yes | FW |
| 3,000 | 2,300 | 8.0 | 100,000 | 100 | | | | NC | 30 | 30 | Succ. | Yes | RW |
| 1,400 | 2,500 | 7.0 | 50-10,000 | 110 | | | | NC | 1,320 | 1,320 | Succ. | Yes | RW |
| 4,000 | 1,000 | 13.0 | 4,060 | 90 | Prim. | 70 | 30.0 | HF | 64,600 | 84,600 | Succ. | Yes | FW |
| 2,000 | 400 | 13.0 | 10 | 250 | S | 63 | 30.0 | NC | 1,100 | 1,100 | Succ. | Yes | FW |
| 2,000 | 200 | 13.0 | 20 | 220 | S | 70 | 30.0 | NC | 725 | 725 | Succ. | Yes | FW |
| 2,800 | 1,000 | 13.0 | 35 | 220 | S | 60 | 30.0 | NC | 120 | 120 | Disc. | No | P (Exp. UL) |
| 2,000 | 1,600 | 12.0 | 6,500 | 230 | SS | 55 | 20.0 | JS | 670 | 565 | TETT | Yes | FW |
| 3,000 | 1,600 | 14.0 | | 90 | SS | 61 | 21.0 | JS | 1,560 | 795 | TETT | Yes | P (Exp. L) |
| 3,400 | 1,000 | 13.0 | 1,500 | 220 | S | 60 | 20.0 | HF | 2,335 | 1,422 | Succ. | Yes | FW |
| 2,000 | 1,600 | 12.0 | 1,500 | 240 | SS | 55 | 20.0 | HF | 580 | 440 | Succ. | Yes | FW |
| 5,000 | 950 | 12.0 | 1,500 | 280 | S | 60 | 20.0 | NC | 2,000 | 1,200 | Succ. | Yes | FW |
| 5,500 | 1,900 | 11.0 | 1,200 | 135 | C | 58 | 15.0 | JS | 1,446 | 1,446 | TETT | No | P (Exp. L) |
| 2,200 | 2,200 | 13.0 | 4,500 | 100 | | 58 | 24.0 | PP | 772 | 772 | Succ. | Yes | RW |
| 1,436 | 1,000 | 14.7 | 665 | 90 | Prim. | 53 | 17.0 | NC | 163 | 163 | Succ. | Yes | RW |
| 900 | 1,600 | 16.2 | 107 | 100 | Prim. | 50 | 20.0 | NC | 45 | 45 | Succ. | Yes | RW |
| 1,000 | 1,200 | 16.2 | 100 | 95 | Prim. | 50 | 20.0 | NC | 35 | 35 | Succ. | Yes | RW |
| 1,000 | 1,900 | 13.6 | 200 | 106 | Prim. | 50 | 20.0 | NC | 30 | 30 | Disc. | Yes | RW |
| 5,181 | 1,350 | 17.0 | 180 | 100 | Prim. | 50 | 20.0 | JS | 100 | | TETT | | RW |
| 1,000 | 1,425 | 14.5 | | 100 | Prim. | 50 | 20.0 | JS | 32 | 32 | TETT | Yes | RW |
| 2,780 | 2,563 | 14.0 | 283 | 123 | WF | 55 | 20.0 | NC | 400 | 400 | Succ. | | P (Exp. L) |
| 1,000 | 1,100 | 13.0 | | | Prim. | 65 | 45.0 | NC | 8,365 | 7,070 | Succ. | Yes | FW |
| 1,550 | 3,000 | 9.0 | 580 | 135 | Prim. | 80 | 60.0 | HF | 1,200 | 700 | Succ. | Yes | FW |
| 3,700 | 1,100 | 11.4 | 10,000 | 110 | SS | 57.2 | 32.3 | HF | 2,530 | 2,250 | Succ. | Yes | FW |
| 1,146 | 700 | 11.4 | 10,000 | 100 | Prim. | 54 | 37.8 | HF | 420 | 210 | Succ. | Yes | FW |
| 1,500 | 1,000 | 11.3 | 100 | 220 | SS | 55 | 34.0 | NC | 1,800 | 1,500 | Succ. | Yes | FW |
| 1,500 | 1,000 | 11.3 | 500 | 170 | Prim. | 57 | 35.0 | NC | 3,300 | 2,435 | Succ. | Yes | FW |
| 2,500 | 800 | 13.6 | 450 | 130 | Prim. | 63 | 49.0 | HF | 166 | 66 | Prom. | No | FW |
| 500 | 2,500 | 14.0 | 580 | 90 | Prim. | 67 | 30.0 | HF | 490 | 300 | Prom. | Yes | P |
| 3,000 | 900 | 13.5 | 8,000 | 90 | S | 30 | 20.0 | HF | 200 | 130 | Succ. | Yes | FW |
| 2,500 | 600 | 13.5 | 5,000 | 78 | S | 35 | 20.0 | HF | 200 | 50 | Prom. | Yes | FW |
| 2,500 | 1,000 | 11.0 | 24,000 | 100 | SF | 20 | 10.0 | NC | | | Disc. | No | P (Exp. UL) |
| 3,000 | 1,000 | 14.0 | 1,600 | 95 | SF | 37.1 | 28.2 | HF | 2,200 | 2,200 | Prom. | Yes | P |
| 100-3,000 | 700 | 13.0 | 4,000 | 85 | Prim. | 45 | 15.0 | NC | 1,600 | 1,200 | Succ. | Yes | FW |
| 2,000 | 200 | 13.0 | 20 | 250 | SF | | | NC | 125 | 125 | Succ. | Yes | P (Exp. L) |
| 2,000 | 400 | 13.0 | 10 | 250 | SF | | | HF | 150 | 150 | Succ. | Yes | P (Exp. L) |
| 4,000 | 1,100 | 13.0 | 40 | 210 | SF | 50 | 30.0 | HF | 300 | 30 | Disc. | No | P (Exp. UL) |
| 3,000 | 2,200 | 13.0 | 4,000 | 100 | S | 38 | 31.0 | JS | 650 | 100 | TETT | Yes | RW |
| 650 | 400 | 19.0 | 660 | | Prim. | 94 | 49.0 | HF | 420 | 420 | Succ. | Yes | FW |
| 85 | 11,300 | 18.0-27.0 | 6.00 | 221 | Prim. | 80 | | NC | 470 | 470 | Succ. | Yes | FW |
| 950 | 5,000 | 10.0 | 1,006 | 185 | Prim. | 63 | 32.0 | JS | 1,050 | 1,050 | Prom. | No | FW |
| 1,790 | 300 | 15.0 | 410 | 95 | Prim. | 63 | 22.0 | NC | 520 | 520 | Succ. | Yes | LW |
| 1,500 | 2,700 | 14.0 | 110 | 125 | | 74 | 37.0 | HF | 1,100 | 1,100 | Succ. | Yes | FW |
| 500-1,000 | 1,600 | 13.0 | 750 | 100 | Prim. | 86 | 37.0 | HF | 980 | 980 | Succ. | Yes | FW |
| 500-4,000 | 1,700 | 11.5 | 2,770 | 110 | Prim. | 70 | | HF | 800 | 700 | Prom. | Yes | Exp. L |
| 960 | 350 | 19.0 | 675 | 130 | Prim. | 60 | 28.5 | NC | 850 | 850 | Succ. | Yes | FW |

# Producing $CO_2$, gas EOR in U.S.

| Operator | Field | State | County | Start date | Area, acres | No. wells Prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$CO_2$ miscible** | | | | | | | | | | | |
| Amoco | Levelland | Tex. | Hockley | 3/73 | 13 | 2 | 6 | San Andres | Dolo. | 11.5 | 4 |
| Amoco | Lost Soldier | Wyo. | Sweetwater | 5/89 | 1,345 | 49 | 66 | Tensleep | S | 9.9 | 31 |
| Amoco | Lost Soldier | Wyo. | Sweetwater | 5/89 | 790 | 31 | 33 | Darwin-Madison | S/LS-Dolo. | 10.3 | 4 |
| Amoco | Slaughter | Tex. | Hockley | 1984 | 6,412 | 230 | 79 | San Andres | Dolo./LS | 10.8 | 2 |
| Amoco | Slaughter | Tex. | Hockley | 12/84 | 5,700 | 201 | 121 | San Andres | Dolo./LS | 12.0 | 5 |
| Amoco | Slaughter | Tex. | Hockley | 12/84 | 1,600 | 70 | 52 | San Andres | Dolo./LS | 10.0 | 4 |
| Amoco | Wasson | Tex. | Yoakum | 11/84 | 7,800 | 321 | 282 | San Andres | Dolo./LS | 9.0 | 5 |
| Amoco | Wertz | Wyo. | Carbon, Sweetwater | 10/86 | 1,400 | 58 | 61 | Tensleep | S | 10.0 | 20 |
| ARCO | Sable | Tex. | Yoakum | 3/84 | 825 | 43 | 21 | San Andres | Dolo. | 8.4 | 2 |
| ARCO | Sho-Vel-Tum | Okla. | Stephens | 9/82 | 1,100 | 70 | 41 | Sims | S | 16.0 | 70 |
| ARCO | Wasson-Willard | Tex. | Yoakum | 1/86 | 8,000 | 286 | 225 | San Andres | Dolo. | 9.0 | 1 |
| Chevron | Kingdom Abo | Tex. | Terry | 5/85 | 2,240 | 59 | 48 | Abo Reef | Dolo. | 4.5 | 8 |
| Chevron | North Ward Estes | Tex. | Ward | 3/89 | 3,840 | 190 | 194 | Yates | S | 16.0 | 37 |
| Chevron | Pittsburg | Tex. | Camp | 6/85 | 43 | 4 | 1 | Pittsburg | LS | 11.0 | 2 |
| Chevron | Quarantine Bay | La. | Plaquemines | 10/81 | 57 | 2 | 1 | 4 Sand Reservoir | S | 30.0 | 100-1,000 |
| Chevron | Rangely Weber Sand | Colo. | Rio Blanco | 10/86 | 15,000 | 130 | 111 | Weber SS | S | 12.0 | 5-50 |
| Chevron | SACROC Unit | Tex. | Scurry | 1/72 | 49,900 | 732 | 387 | Canyon Reef | LS | 3.9 | 19 |
| Chevron | Timbalier Bay | La. | Lafourche | 4/84 | 37 | 2 | 1 | S-2B | S | 30.0 | 9,244 |
| Citronelle | Citronelle | Alas. | Mobile | 5/81 | 1,680 | 42 | 10 | Rodessa | S | 10-16 | 5-75 |
| Conoco | Ford Geraldine Unit | Tex. | Reeves & Culberson | 2/81 | 3,850 | 91 | 69 | Delaware | S | 23.0 | 64 |
| Conoco | Maljamar | N.M. | Lea and Eddy | 1/89 | 1,200 | 70 | 15 | Grayburg-San Andres | Dolo/S | 10.8 | 5 |
| Enron Oil & Gas | Twofreds | Tex. | Loving, Ward, Reeves | 1/74 | 4,392 | 45 | 36 | Delaware | S | 19.5 | 32 |
| Exxon | Cordona Lake | Tex. | Crane | 12/85 | 2,084 | 29 | 25 | Devonian | Tripol. | 22.0 | 4 |
| Exxon | Means (San Andres) | Tex. | Andrews | 11/83 | 8,500 | 364 | 184 | San Andres | Dolo | 9.0 | 20 |
| Exxon | Slaughter | Tex. | Hockley | 5/85 | 569 | 19 | 11 | San Andres | Dolo. | 12.5 | 6 |
| Exxon | Wasson (Cornell Unit) | Tex. | Yoakum | 7/85 | 1,923 | 58 | 51 | San Andres | Dolo. | 8.6 | 2 |
| George R. Brown | Rose City North | Tex. | Orange | 4/81 | 800 | 3 | 5 | Hackberry | S | 37.0 | 4,500 |
| George R. Brown | Rose City South | Tex. | Orange | 1/83 | 900 | 8 | 5 | Hackberry | S | 37.0 | 4,500 |
| Mitchell Energy | Alvord South | Tex. | Wise | 1980 | 2,291 | 17 | 17 | Caddo | Congl. | 12.8 | 55 |
| Mobil | GMK South | Tex. | Gaines | 1982 | 1,143 | 31 | 29 | San Andres | LS | 9.8 | 3 |
| Mobil | McElmo Creek Unit | Utah | San Juan | 2/85 | 13,440 | 155 | 110 | Ismay Desert Creek | LS | 14.0 | 5 |
| Mobil | Slaughter | Tex. | Hockley | 6/89 | 2,495 | 79 | 46 | San Andres | Dolo | 10.3 | 3 |
| Mobil | Wasson | Tex. | Yoakum | 10/85 | 640 | 30 | 26 | San Andres | Dolo. | 13.0 | 6 |
| Pennzoil | Tinsley | Miss. | Yazoo | 11/81 | 1,338 | 15 | 15 | Perry | S | 26.4 | 49 |
| Phillips | Bridger Lake | Utah | Summit | 4/70 | 3,800 | 7 | 1 | Dakota | S | 12.8 | 79 |
| Phillips | Vacuum | N.M. | Lea | 2/81 | 4,900 | 192 | 100 | San Andres | Dolo. | 11.7 | 11 |
| Phillips | Maljamar | N.M. | Lea | 11/89 | 40 | 4 | 1 | Grayburg | S/Dolo. | 6.0 | 0 |
| Santa Fe Energy | Raymond | Mont. | Sheridan | 8/83 | 685 | 2 | 1 | Nisku | LS | 8.2 | 13 |
| Shell | Crossett (N. Cross) | Tex. | Crane & Upton | 4/72 | 1,500 | 27 | 11 | Devonian | Tripol. | 22.0 | 5 |
| Shell | Crossett (S. Cross) | Tex. | Crockett | 6/88 | 800 | 21 | 10 | Devonian | Tripol | 21.0 | 4 |
| Shell | Little Creek | Miss. | Lincoln & Pike | 12/85 | 6,200 | 56 | 20 | Lower Tuscaloosa | S | 23.0 | 33 |
| Shell | Olive | Miss. | Pike | 10/87 | 1,280 | 16 | 6 | Lower Tuscaloosa | S | 26.0 | 50 |
| Shell | Wasson (Denver) | Tex. | Yoakum & Gaines | 4/83 | 20,000 | 780 | 380 | San Andres | Dolo. | 12.0 | 8 |
| Shell | Wasson (South) | Tex. | Gaines | 1/86 | 3,500 | 100 | 60 | Clearfork | Dolo. | 6.0 | 2 |
| Shell | West Mallalieu | Miss. | Lincoln | 11/86 | 5,760 | 14 | 4 | Lower Tuscaloosa | S | 25.0 | 20 |
| Stanberry Oil | Farnsworth, North | Tex. | Ochiltree | 6/80 | 1,431 | 9 | 5 | Marmaton B | LS | 11.5 | 140 |
| Stanberry Oil | Hansford Marmaton | Tex. | Hansford | 6/80 | 2,010 | 9 | 10 | Marmaton | S | 18.1 | 48 |
| Texaco | Paradis | La. | St. Charles | 2/82 | 347 | 7 | 6 | Lower 9,000-Ft | S | 26.0 | 770 |
| Texaco | Paradis | La. | St. Charles | 2/82 | 320 | 1 | 0 | No. 8 | S | 27.0 | 795 |
| Texaco | Paradis | La. | St. Charles | 1/88 | 44 | 1 | 1 | 9,500 Ft | S | 24.0 | 252 |
| Union Texas | Wellman | Tex. | Terry | 7/83 | 1,400 | 32 | 7 | Wolfcamp | LS | 9.2 | >100.0 |
| Unocal | Dollarhide | Tex. | Andrews | 5/85 | 6,183 | 83 | 66 | Devonian | Dolo./Tripol | 13.5 | 9 |
| **$CO_2$ immiscible** | | | | | | | | | | | |
| Chevron | Timbalier Bay | La. | Lafourche | 12/85 | 422 | 10 | | 4,900 ft Sand | S | 32.0 | 500-2,500 |
| Marathon Oil | Yates | Tex. | Pecos & Crockett | 11/85 | 14,300 | 862 | 23 | Grayburg/San Andres | Dolo. | 17.0 | 175 |
| Shell Western E&P | Weeks Island | La. | New Iberia | 1/88 | 480 | 18 | 6 | S RES A | S | 23.0 | 150-4,000 |
| Shell Western E&P | Weeks Island | La. | New Iberia | 1/88 | 908 | 8 | 2 | R RES A | S | 23.0 | 100-1,500 |
| **Hydrocarbon miscible** | | | | | | | | | | | |
| Amoco | Levelland | Tex. | Hockley | 5/71 | 1,422 | 81 | 50 | San Andres | Dolo. | 10.2 | 2 |
| ARCO | Prudhoe Bay | Alas. | | 12/82 | 3,650 | 42 | 11 | Sadlerochit | S | 23.0 | 300 |
| ARCO | South Pass Block 61 | OCS | | 8/83 | 55 | 1 | 1 | 1 RK2 | S | 30.0 | 25 |
| ARCO | South Pass Block 61 | OCS | | 8/85 | 54 | 2 | 1 | LL RBB1, 2 | S | 30.0 | 175 |
| ARCO | South Pass Block 61 | OCS | | 5/81 | 320 | 8 | 3 | UM RAAO, 2, 3 | S | 30.0 | 180 |
| ARCO | South Pass Block 61 | OCS | | 5/81 | 112 | 5 | 2 | UM RBB | S | 30.0 | 300 |
| ARCO | South Pass Block 61 | OCS | | 8/83 | 26 | 1 | 1 | LL RG | S | 33.0 | 10 |
| ARCO | South Pass Block 61 | OCS | | 8/83 | 39 | 1 | 1 | UJ RL | S | 33.0 | 50 |
| ARCO | South Pass Block 61 | OCS | | 5/81 | 54 | 4 | 2 | MM RBB | S | 30.0 | 300 |
| ARCO | South Pass Block 61 | OCS | | 10/84 | 68 | 3 | 3 | LK2 RU | S | 29.0 | 100 |
| ARCO | South Pass Block 61 | OCS | | 2/84 | 37 | 2 | 1 | LL ART | S | 30.0 | 50 |
| ARCO | South Pass Block 61 | OCS | | 5/81 | 179 | 7 | 2 | MM RAAO, 2, 3 | S | 30.0 | 180 |
| ARCO | West Devil's Pocket | Tex. | Newton | 7/87 | 1,726 | 6 | 1 | Wilcox 11,500 ft | S | 12.3 | 1 |
| ARCO | Kuparuk River | Alas. | | 6/88 | 5,120 | 30 | 20 | Kuparuk "A" & "C" Sands | | 25.0 | 50-1,000 |
| ARCO | Prudhoe Bay | Alas. | | 2/87 | 17,200 | 190 | 56 | Sadlerochit | S | 22.0 | 500 |
| ARCO | Sabine Tram. SW (Wilcox 11500) | Tex. | Newton | 12/89 | 2,010 | 7 | 1 | Wilcox 11,500 ft | S | 14.0 | 27 |
| Exxon | South Pass Block 89 | Tex. | | 12/83 | 204 | 10 | 10 | X and Y Series | S | 29.0 | 100-1,500 |
| Hunt | Fairway | Tex. | Anderson/Henderson | 3.66 | 22,618 | 95 | 65 | James | LS | 12.6 | 11 |
| Kerr-McGee | North Buck Draw | Wyo. | Campbell | 12/88 | 5,700 | 11 | 8 | Dakota | S | 9.3 | 3 |

| Depth, ft | Reservoir oil Gravity, °API | cp | °F. | Prev. prod. | Satur. % start | Satur. % end | Proj. maturity | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Proj. scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,900 | 30.0 | 2.30 | 105 | WF | 74 | | NC | 28 | 28 | Succ. | | P (Exp. L) |
| 5,000 | 35.0 | 1.30 | 178 | WF | | | JS | 6,500 | 4,570 | Succ. | Yes | FW |
| 5,400 | 35.0 | 1.40 | 181 | WF | | | JS | 2,700 | 764 | Prom. | Yes | FW |
| 4,900 | 31.0 | 1.40 | 105 | WF | | | JS | 3,850 | 1,100 | Prom. | Yes | FW |
| 4,950 | 31.0 | 1.40 | 105 | WF | | | JS | 9,095 | 4,015 | Succ. | Yes | FW |
| 4,950 | 31.0 | 1.40 | 105 | WF | | | JS | 3,900 | 1,900 | Succ. | Yes | FW |
| 5,100 | 32.0 | 1.30 | 110 | WF | | | JS | 16,000 | 8,000 | Succ. | Yes | FW |
| 6,000 | 35.0 | 1.16 | 163 | WF | | | HF | 10,000 | 7,200 | Succ. | Yes | FW |
| 5,200 | 32.0 | 1.46 | 107 | WF | | | JS | 680 | 380 | Succ. | Yes | FW |
| 6,200 | 25.0 | 3.30 | 115 | WF | 59 | 42.0 | HF | 2,140 | 1,330 | Succ. | Yes | LW |
| 5,100 | 32.0 | 2.01 | 110 | WF | | | JS | 4,800 | 1,600 | Succ. | Yes | FW |
| 7,500 | 28.5 | 3.40 | 120 | WF | 58 | 40.0 | JS | 2,790 | | TETT | | FW |
| 2,600 | 35.0 | 1.40 | 83 | WF | 25 | 10.0 | JS | 1,730 | 480 | TETT | | |
| 8,000 | 41.0 | 0.80 | 205 | WF | 59 | | NC | 130 | 100 | Succ. | Yes | P (Exp. L) |
| 8,120 | 32.0 | 0.99 | 183 | Prim. | 33 | 15.0 | NC | 125 | 125 | Prom. | No | P (Exp. UL) |
| 5,500-6,500 | 35.0 | 1.70 | 160 | Prim./WF | 38 | 29.0 | JS | 30,700 | 7,150 | Prom. | | FW |
| 6,700 | 41.0 | 0.35 | 130 | Prim./WF | 63.3 | 46.8 | NC | 25,540 | 13,780 | Succ. | Yes | FW |
| 7,400 | 39.0 | 0.39 | 180 | Prim. | 29 | | HF | 250 | 250 | TETT | No | P (Exp. L) |
| 11,000 | 42.0 | 46 | 210 | Prim./WF | 63 | | PP | 3,300 | 350 | Prom. | | Expl. L: |
| 2,680 | 40.0 | 1.40 | 83 | Prim./WF | 41 | 35.0 | HF | 1,500 | 1,500 | Succ. | No | FW |
| 3,650-4,200 | 37.0 | 1.00 | 95 | | 55.6 | 40.0 | JS | 1,000 | | TETT | | Exp. L |
| 4,900 | 36.0 | 1.50 | 105 | WF | | | NC | 680 | 680 | Succ. | Yes | FW |
| 5,500 | 40.0 | 0.50 | 101 | WF | | | JS | 2,100 | 360 | Prom. | Prom. | LW |
| 4,300 | 29.0 | 6.00 | 97 | WF | | | JS | | | Succ. | Succ. | |
| 4,900 | 32.0 | 1.30 | 110 | WF | | | JS | 650 | 90 | TETT | | LW |
| 4,500 | 33.0 | 1.00 | 106 | WF | | | JS | 2,000 | 100 | TETT | | LW |
| 8,200 | 37.0 | 2.00 | 180 | WF | 50 | 35.0 | NC | 160 | 160 | Prom. | | FW |
| 8,200 | 37.0 | 2.00 | 180 | WF | 50 | 35.0 | HF | 800 | 600 | Prom. | | FW |
| 5,700 | 44.0 | 0.39 | 154 | WF | 60 | 52.0 | HF | 297 | 80 | Prom. | No | FW |
| 5,400 | 30.0 | 2.57 | 101 | WF | 55 | 28.0 | JS | 1,800 | 300 | Succ. | Yes | LW |
| 5,600 | 41.0 | 0.50 | 125 | Prim./WF | 50 | | JS | 5,450 | 1,600 | Prom. | Yes | FW |
| 5,000 | 32.0 | 1.60 | 107 | WF | 45 | 8.0 | JS | 1,400 | | TETT | Yes | LW |
| 5,100 | 33.0 | 0.97 | 110 | WF | 54.4 | 39.2 | NC | 1,700 | 300 | Prom. | Yes | FW |
| 4,800 | 39.0 | 1.50 | 175 | WF | 65 | 38.0 | HF | 260 | 260 | Prom. | No | FW |
| 15,600 | 40.0 | 0.36 | 225 | Prim. | 70 | 61.0 | NC | 650 | 250 | Succ. | Yes | FW |
| 4,500 | 38.0 | 1.00 | 101 | Prim. | 70 | 50.0 | JS | 9,000 | | Succ. | Yes | FW |
| 4,600 | 36.0 | 1.10 | 101 | Prim. | 60 | 29.0 | JS | 40 | | TETT | | P |
| 7,900 | 40.0 | 0.40 | 178 | Prim. | | | HF | 85 | 60 | Prom. | Yes | |
| 5,300 | 44.0 | 0.36 | 106 | | 49 | 21.0 | HF | 1,934 | 1,934 | Succ. | Yes | FW |
| 5,200 | 43.0 | 0.60 | 104 | | 43 | 24.0 | JS | 565 | | TETT | | Exp. L |
| 10,640 | 39.0 | 0.40 | 248 | WF | 21 | 2.0 | JS | 3,900 | 3,900 | Prom. | | FW |
| 10,500 | 39.0 | 0.34 | 250 | WF | 17 | 2.0 | JS | 950 | 950 | Succ. | Yes | FW |
| 5,200 | 33.0 | 1.30 | 105 | WF | 51 | 30.5 | JS | 41,100 | 25,300 | Succ. | Yes | FW |
| 6,700 | 33.0 | 1.10 | 105 | WF | 60 | | JS | 5,800 | 400 | Prom. | | FW |
| 10,365 | 38.0 | 0.50 | 245 | Prim. | 15 | 1.0 | JS | 1,500 | 1,500 | TETT | | FW |
| 6,400 | 44.0 | 1.61 | 131 | WF | 57 | | HF | 300 | 300 | Succ. | Yes | FW |
| 6,500 | 44.0 | 1.56 | 142 | Prim. | 43 | | HF | 420 | 420 | Succ. | Yes | FW |
| 10,400 | 37.0 | 0.50 | 205 | Prim. | 62 | 48.0 | HF | 400 | 400 | Prom. | No | RW |
| 8,600 | 39.0 | 0.40 | 192 | Prim. | 30 | 20.0 | NC | 125 | 125 | Prom. | No | RW |
| 9,800 | 38.0 | 35 | 192 | Prim. | 45 | 33.0 | HF | 100 | 100 | Prom. | No | RW |
| 9,800 | 43.5 | 0.54 | 151 | WF | 35 | 10.0 | JS | 3,600 | 400 | TETT | | FW |
| 8,000 | 40.0 | 0.44 | 122 | Prim./WF | 35 | 22.0 | JS | 2,200 | 400 | Prom. | | FW |
| 4,878 | 26.0 | 1.70 | 138 | Prim. | 60 | | NC | 124 | 95 | Prom. | Yes | RW |
| 1,100-1,700 | 30.0 | 5.50 | 82 | GI | | | HF | 57,923 | | Prom. | Yes | FW |
| 14,100 | 33.0 | 0.42 | 242 | Prim. | 28 | 5.0 | JS | | | TETT | Yes | RW |
| 13,200 | 34.0 | 0.41 | 241 | Prim. | 28 | 5.0 | JS | | | TETT | Yes | RW |
| 4,900 | 30.0 | 2.30 | 105 | Prim. | 90 | | HF | 2,185 | 2,185 | Succ. | | P (Exp. UL) |
| 8,800 | 27.0 | 0.90 | 200 | Prim. | 65 | 25.0 | JS | 50,000 | 10,000 | Prom. | | P (Exp. L) |
| 4,900 | 39.0 | 0.70 | 150 | Prim. | 65 | 25.0 | NC | 57 | 6 | Succ. | Yes | FW |
| 5,750 | 29.0 | 1.70 | 158 | Prim. | 66 | 28.0 | NC | 130 | 55 | Succ. | Yes | FW |
| 9,000 | 41.0 | 0.38 | 200 | WF | 78 | 25.0 | HF | 2,800 | 2,800 | Succ. | Yes | FW |
| 6,300 | 37.0 | 0.70 | 165 | WF | 78 | 27.0 | HF | 1,100 | 400 | Succ. | Yes | FW |
| 6,800 | 43.0 | 0.40 | 170 | Prim. | 73 | 31.0 | NC | 37 | 10 | Succ. | Yes | FW |
| 5,500 | 40.0 | 0.40 | 150 | Prim. | 77 | 26.0 | NC | 237 | 24 | Succ. | Yes | FW |
| 6,400 | 37.0 | 0.70 | 165 | WF | 78 | 27.0 | HF | 2,080 | 1,960 | Succ. | Yes | FW |
| 7,900 | 36.0 | 0.50 | 180 | Prim. | 67 | 27.0 | HF | 420 | 150 | Succ. | Yes | FW |
| 8,500 | 33.0 | 0.86 | 190 | Prim. | 70 | 30.0 | HF | 162 | 41 | Succ. | Yes | FW |
| 9,100 | 38.0 | 0.30 | 190 | WF | 76 | 26.0 | HF | 1,650 | 1,650 | Succ. | Yes | FW |
| 11,525 | 45.9 | 0.13 | 266 | Prim. | 53 | 24.9 | JS/HF | 354 | 167 | Prom. | | FW (Exp. UL) |
| 5,900 | | 2.00 | | | 40-50 | 25-35 | | 24,000 | | | | |
| 8,800 | 27.0 | 0.90 | 200 | WF | 50 | 25.0 | JS | 300,000 | 10,000 | Prom. | | FW |
| 11,525 | 49.0 | 0.10 | 271 | Prim. | 55 | 15.0 | JS | 550 | | TETT | | FW (Exp. UL) |
| 11,270 | 38-40.0 | 0.40-0.60 | 165 | Prim. | 89 | 73.0 | HF | 14,000 | 10,000 | Prom. | Yes | RW |
| 9,900 | 48.0 | 0.15 | 260 | Prim. | 73 | 36.0 | NC | 5,110 | 5,110 | Succ. | Yes | FW |
| 12,450 | 46.0 | 0.12 | 282 | Prim. | 85 | 35.0 | JS | 11,000 | 8,000 | Succ. | | RW |

## Producing $CO_2$, gas EOR in U.S.—continued

| Operator | Field | State | County | Start date | Area, acres | No. wells Prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oryx | Fordoche W-12 | La. | Pt. Coupee | 5/80 | 3,400 | 6 | 0 | Wilcox | S | 19.0 | 5 |
| Oryx | Fordoche W-8 | La. | Pt. Coupee | 5/80 | 3,300 | 8 | 3 | Wilcox | S | 20.0 | 9 |
| Oxy USA | Northeast Purdy | Okla. | Garvin | 9/82 | 8,320 | 106 | 102 | Springer | S | 13.0 | 44 |
| True Oil | Red Wing Creek | N. Dak. | McKenzie | 1/82 | 640 | 8 | 1 | Mission Canyon | LS | 10.0 | 0.1 |
| **Hydrocarbon immiscible** | | | | | | | | | | | |
| ARCO | Kuparuk River | Alas. | | 2/86 | 30,000 | 100 | 85 | Kuparuk A & C Sands | S | 22.0 | 50-500 |
| **Nitrogen miscible** | | | | | | | | | | | |
| Exxon | Blackjack Creek | Fla. | Santa Rosa | 2/81 | 4,600 | 8 | 8 | Smackover | LS | 16.0 | 112 |
| **Nitrogen immiscible** | | | | | | | | | | | |
| Chevron | East Painter | Wyo. | Uinta | 11/83 | 1,500 | 17 | 7 | Nugget | S | 11.0 | 3 |
| Chevron | Painter | Wyo. | Uinta | 6/80 | 1,360 | 33 | 13 | Nugget | S | 11.9 | 4 |
| Chevron | Stonebluff | Okla. | Wagoner | 3/82 | 540 | 18 | 15 | Dutcher | S | 16.0 | 200 |
| Exxon | Fanny Church | Ala. | Escambia | 1985 | 600 | 3 | 0 | Smackover | LS | 12.0 | 5 |
| Exxon | Jay-Little Escambia Crk | Fla/Ala. | Santa Rosa/ Escambia | 1/81 | 14,415 | 50 | 30 | Smackover | LS | 14.0 | 35 |
| Phillips | Andector | Tex. | Ector | 11/81 | 1,931 | 20 | 0 | Ellenburger | Dolo. | 3.0 | 100 |
| Phillips | Binger | Okla. | Caddo | 1977 | 12,960 | 62 | 30 | Marchand | S | 7.5 | 0.2 |
| Unocal | Chunchula Fieldwide Unit | Ala. | Mobile | 4/82 | 23,279 | 31 | 8 | Smackover Carbonate | Dolo. | 12.4 | 10 |
| **Flue gas** | | | | | | | | | | | |
| ARCO | Block 31 | Tex. | Crane | 6/49 | 7,840 | 195 | 98 | Devonian | LS | 12.0 | 5 |
| Exxon | Hawkins | Tex. | Wood | 4/77 | 10,590 | 491 | 41 | Woodbine | S | 28.0 | 3,400 |
| **Flue gas immiscible** | | | | | | | | | | | |
| Exxon | Hawkins | Tex. | Wood | 8/87 | 2,800 | 100 | 6 | Woodbine | S | 28.0 | 3,400 |

## Producing chemical EOR projects in U.S.

| Operator | Field | State | County | Start date | Area, acres | – Number wells – Prod. | Inj. | Pay zone | Formation type | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Polymer** | | | | | | | | | | | |
| Anderson Oil | North Glo | Wyo. | Campbell | 10/87 | 292 | 4 | 2 | Minnelusa | S | 15.9 | 150 |
| ARCO | Hamilton Dome | Wyo. | Hot Springs | 9/89 | 80 | 7 | 1 | Tensleep | S | 14.0 | 58 |
| Cenex | Sage Spring Crk-Unit A | Wyo. | Natrona | 8/78 | 1,456 | 8 | 5 | Dakota | S | 13.0 | 50 |
| Chevron | N. Stanley | Okla. | Osage | 2/76 | 810 | 18 | 11 | Burbank | S | 18.0 | 300 |
| Chevron | S. Stanley | Okla. | Osage | 6/83 | 1,280 | 10 | 16 | Burbank | S | 18.0 | 300 |
| Chevron | W. Bay | La. | Plaquemines | 10/81 | 64 | 3 | 2 | 3A Sand | S | 30.0 | 40 |
| Chevron | W. Bay | La. | Plaquemines | 10/81 | 42 | 4 | 1 | 3A Sand | S | 34.0 | 4,600 |
| Conoco | Vacuum-State #35 Lease | N.M. | Lea | 3/83 | 240 | 5 | 10 | Grayburg/San Andres | S/LS | 10.9 | 14 |
| Enron Oil & Gas | Isenhour | Wyo. | Sublette | 7/80 | 173 | 2 | 3 | Almy | S | 15.0 | 1.0-25.0 |
| Enron Oil & Gas | Long Island-Star Corral | Wyo. | Sublette | 8/69 | 173 | 3 | 2 | Almy | S | 15.5 | 1.0-50.0 |
| Enron Oil & Gas | McDonald Draw #1TB | Wyo. | Sublette | 1/72 | 435 | 1 | 1 | Almy | S | 16.7 | 2.0-59.0 |
| Enron Oil & Gas | McDonald Draw #4TB | Wyo. | Sublette | 7/72 | 420 | 10 | 3 | Almy | S | 18.0 | 1.0-200.0 |
| Enron Oil & Gas | Ruben | Wyo. | Sublette | 12/70 | 800 | 5 | 4 | Almy | S | 14.1 | 1.0-56.0 |
| Enron Oil & Gas | Saddle Ridge Unit | Wyo. | Sublette | 12/74 | 376 | 8 | 5 | Mesaverde | S | 22.0 | 10.0-95.0 |
| Fina Oil | South Cowden | Tex. | Ector | 6/84 | 666 | 25 | 15 | Grayburg | Dolo. | 10.1 | 4 |
| Gallagher Drilling | Stewart East Minnelusa Unit | Wyo. | Campbell | 7/82 | 200 | 4 | 1 | Minnelusa | S | 15.6 | 250 |
| Hunt | East Texas | Tex. | Rusk | 8/82 | 508 | 76 | 11 | Woodbine | S | 22.0 | 300 |
| Lamamco Drilling¶ | Naval Reserve | Okla | Osage | 2/82 | 3,360 | 121 | 33 | Bartlesville | S | 15.8 | 12 |
| Marathon Oil | Grass Creek | Wyo. | Hot Springs | 10/85 | 740 | 40 | 18 | Phosphoria/Tensleep | LS/S | 21.6 | 20.0/112.0 |
| Marathon Oil | Ore.Basin-No.Embar Tensleep | Wyo. | Park | 11/83 | 3,000 | 154 | 97 | Embar/Tensleep | LS/S | 20.2 | 68.0/193.0 |
| Marathon Oil | Oregon Basin-SETPA | Wyo. | Park | 1/85 | 6,108 | 180 | 33 | Embar/Tensleep | LS/S | 15.9 | 9.0/140.0 |
| Marathon Oil | Kinney Coastal | Wyo. | Park/Big Horn | 11/84 | 1,500 | 36 | 23 | Tensleep | S | 11.2 | 50 |
| Marathon Oil | Main Consolidated | Ill. | Crawford | 7/81 | 130 | 11 | 11 | Robinson | S | 18.0 | 115 |
| Marathon Oil | Yates | Tex. | Pecos | 12/83 | 6,900 | 323 | 256 | Queen Grayburg/ San Andres | Dolo. | 15.0 | 62 |
| Mitchell Energy | Alba Northeast Unit | Tex | Wood | 7/80 | 410 | 5 | 1 | Sub-Clarksville | S | 21.4 | 471 |
| Mitchell Energy | Alba SEFB Unit | Tex | Wood | 2/72 | 731 | 21 | 7 | Sub-Clarksville | S | 23.3 | 525 |
| Mitchell Energy | Jacksboro S. | Tex | Jack | 5/82 | 270 | 5 | 8 | Strawn | S | 19.9 | 86 |
| Natl. Coop. Refinery | Stewart Ranch | Wyo | Campbell | 2/72 | 1,200 | 14 | 14 | Minnelusa | S | 16.5 | 92 |
| Oryx | Hitts Lake | Tex | Smith | 10/80 | | 19 | 7 | Paluxy | S | 18.9 | 300 |
| Oxy USA | Harmony Hill | Kan | Rooks | 10/84 | 130 | 5 | 3 | Lansing/Kansas City | LS | 12.5 | |
| Oxy USA | Hoof | Kan. | Graham | 6/82 | 960 | 18 | 8 | Lansing/Kansas City | LS | 12.0 | 74.0-113.0 |
| Phillips | North Burbank | Okla | Osage | 9/80 | 1,440 | 65 | 33 | Burbank | S | 15.5 | 50 |
| Phillips | South Cowden | Tex | Ector | 9/83 | 2,050 | 64 | 23 | Grayburg | Dolo. | 11.9 | 4 |
| Santa Fe Energy | Candy Draw | Wyo | Campbell | 5/87 | 482 | 12 | 1 | Minnelusa | S | 16.0 | |
| Unocal | Dos Cuadras | Calif. | Santa Barbara | 6/83 | 320 | 37 | 10 | EP/FP | S | 27.0 | 260.0-680.0 |
| Unocal | Farnsworth | Tex. | Ochiltree | 9/83 | 13,005 | 37 | 40 | Morrow | S | 14.5 | 22 |
| Unocal | Healdton | Okla | Carter | 12/82 | 2,010 | 174 | 107 | Healdton Sands | S | 26.2 | 346 |
| Unocal | Osage-Hominy | Okla. | Osage | 4/83 | 2,880 | 96 | 36 | Miss. Chat | LS | 30.0 | 27 |
| Western Production | Clareton | Wyo | Weston | 10/85 | 240 | 6 | 1 | Newcastle | S | 15-18 | 1-15 |
| Western Production | Mush Creek | Wyo. | Weston | 1969 | 880 | 4 | 3 | Newcastle | S | 15-19 | 1-15 |
| **Micellar-polymer** | | | | | | | | | | | |
| Chevron | Berry Hill (Kiefer) | Okla. | Creek | 9/82 | 82 | 12 | 21 | Glenn | S | 20.0 | 150 |

Table H

| Depth, ft | Reservoir oil |  |  | Prev. prod. | Satur. % start | Satur. % end | Proj. maturity | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Proj. scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gravity, °API | cp | °F. |  |  |  |  |  |  |  |  |  |
| 13,650 | 45.0 | 0.13 | 274 |  |  |  | NC | 338 | 338 | Succ. | Yes | FW |
| 13,200 | 44.0 | 0.13 | 267 |  |  |  | HF | 490 | 490 | Succ. | Yes | FW |
| 9,400 | 38.0 | 1.20 | 148 | WF | 46 | 40.0 | HF | 3,400 | 2,000 | Succ. |  | FW |
| 9,000 | 40.0 | 0.25 | 241 | Prim. | 60 | 20.0 | JS | 1,200 |  | Succ. | Yes | FW |
| 6,000 | 24.0 | 2.20 | 158 | WF | 57 | 54.0 | JS | 100,000 |  | Prom. | Yes |  |
| 15,700 | 48.0 | 0.30 | 286 | WF | 59 |  | NC | 1,280 | 560 | Prom. | Yes | FW |
| 12,000 | 46.0 | 0.20 | 185 | HC | 98.5 | 52.0 | HF | 9,700 | 3,700 | TETT |  | FW |
| 11,500 | 46.0 | 0.20 | 174 | HC | 47 |  | HF | 3,500 | 1,450 | TETT |  | FW |
| 1,200 | 28.0 | 5.00 | 85 | Prim. | 67 |  | NC | 48 | 30 |  |  | FW |
| 15,565 | 51.0 | 0.15 | 288 | Prim. | 76 |  | NC | 1,000 | 500 | Disc. |  | FW |
| 15,400 | 51.0 | 0.20 | 285 | WF | 59 | 46.0 | HF | 12,800 | 11,000 | Prom. | Yes | FW |
| 8,835 | 44.0 | 0.60 | 132 | Prim. | 43.8 | 37.0 | NC | 4,420 |  | Succ. | Yes | LW |
| 10,000 | 38.0 | 0.30 | 190 | Prim. | 76 | 59.0 | HF | 2,000 | 2,000 | Succ. | Yes | FW |
| 18,500 | 54.0 | 0.18 | 325 | Prim. | 80 | 45.0 | JS | 8,100 | 3,000 | Succ. | Yes | FW |
| 8,600 | 46.0 | 0.30 | 130 | Prim. |  |  | NC | 7,700 | 6,300 | Succ. | Yes | FW |
| 4,530 | 24.0 | 3.70 | 168 | Prim. | 88 | 12.0 | NC |  | 11,000 | Succ. | Yes | FW |
| 4,600 | 24.0 | 3.70 | 168 |  | 35 | 12.0 | JS |  |  | TETT | Yes | Exp. L |

Table I

| Depth, ft | Reservoir oil |  |  | Previous prod. | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gravity, °API | cp | °F. |  |  |  |  |  |  |  |  |  |
| 7,900 | 20.2 | 29.70 | 130 | Prim | 74.4 | 33.3 | HF | 726 | 613 | Succ. |  | FW |
| 2,750 | 20.0 | 39 | 135 | WF |  |  | JS | 350 |  | TETT | Yes | Exp. L. |
| 7,400 | 36.0 | 1.40 | 160 | WF | 45 | 21.0 | NC | 265 | 130 | Succ. | Yes | FW |
| 2,900 | 36.0 | 2.36 | 107 | WF | 51 |  | NC | 300 | 200 | Succ. |  | FW |
| 2,900 | 32.0 | 2.50 | 165 | Prim. | 54 |  | NC | 190 |  |  |  | FW |
| 7,100 | 41.0 | 2.30 | 120 | WF | 36 | 32.0 | HF |  |  |  |  |  |
| 7,100 | 30.0 | 2.40 | 165 | Prim. | 65 |  | HF |  |  |  | No |  |
| 4,500 | 37.0 | 1.30 | 101 | Prim./WF | 52 | 43.0 | HF | 425 |  | Succ. | Yes | FW |
| 3,600 | 41.5 | 1.[illegible] | 100 | Prim. | 38.1 | 27.0 | NC | 40 | 10 | Succ. | Yes | FW |
| 3,550 | 44.0 | 1.20 | 100 | Prim. | 43.6 | 23.9 | NC | 30 | 1 | Succ. | Yes | FW |
| 3,050 | 42.0 | 1.40 | 90 | WF | 40 | 36.7 | NC | 18 | 1 | Succ. | Yes | FW |
| 3,200 | 41.8 | 1.45 | 95 | WF | 43.8 | 29.1 | NC | 125 | 7 | Succ. | Yes | FW |
| 3,300 | 43.0 | 0.95 | 95 | Prim. | 42 | 25.4 | NC | 120 | 8 | Succ. | Yes | FW |
| 1,800 | 44.0 | 2.33 | 85 | Prim. | 37.5 | 27.3 | NC | 155 | 10 | Succ. | Yes | FW |
| 4,500 | 35.0 | 1.90 | 96-100 | WF | 57 | 53.0 | HF | 1,600 | 100 | Succ. | Yes | LW |
| 8,000 | 20.0 | 20.00 | 124 | Prim. | 65 | 37.7 | NC | 126 | 100 | Succ. | Yes | FW |
| 3,500 | 37.0 | 1.90 | 142 | Prim. | 57 | 33.0 | NC | 530 | 330 | Succ. | Yes | LW |
| 2,650 | 38.0 | 3.50 | 90 | WF | 27.2 | 26.7 | NC | 549 | 15 | Succ. | Yes | FW |
| 4,300/4,500 | 24.0/24.0 | 15.00/15.00 | 105/110 | Prim./WF |  |  | NC | 2,485 | 920 | Succ. | Yes | FW |
| 3,370/3,520 | 22.5/22.1 | 8.5/11.0 | 108/110 | Prim./WF | 52 | 40.0 | NC | 10,900 | 2,500 | Succ. | Yes | FW |
| 3,600/3,840 | 21.0/21.0 | 25/15 | 100 | Prim./WF | 54 | 39.0 | NC | 9,200 | 3,000 | Succ. | Yes | FW |
| 4,240 | 22.1 | 11.30 | 140 | Prim./WF |  |  | HF | 1,561 | 431 | Succ. | Yes | FW |
| 1,100 | 30.0 | 18 | 70 | Prim. | 51 |  | NC | 18 | 18 | Disc. | No | P (Exp. UL) |
| 1,500 | 30.0 | 5.50 | 82 | Prim. |  |  | NC | 12,159 |  | Succ. | Yes | FW |
| 4,100 | 15.1 | 75 | 150 | WF | 62.6 | 52.1 | NC | 38 | 38 | Disc. | Yes | FW |
| 4,200 | 15.5 | 75 | 150 | Prim. | 69.5 | 51.8 | NC | 117 | 117 | Succ. | Yes | FW |
| 1,975 | 40.0 | 1.73 | 100 | Prim. | 50 | 22.0 | NC | 85 | 85 | Succ. | Yes | FW |
| 8,100 | 20.0 | 25 | 136 | WF | 68 | 49.0 | NC | 950 | 1,013 | Succ. | Yes | FW |
| 7,250 | 26.0 | 2.71 | 210 | WF |  |  | NC | 950 |  | Succ. | Yes | FW |
| 3,130 | 38.6 | 3.70 | 105 | Prim. | 49 | 34.0 | NC | 81 | 81 | Succ. | Yes | FW |
| 3,700 | 41.0 | 2.30 | 120 | WF | 36 |  | NC | 75 | 33 |  | No | FW |
| 2,900 | 39.0 | 3.00 | 120 | WF | 53 | 47.0 | NC | 459 | 304 | Succ. | Yes | FW |
| 4,750 | 35.0 | 3.40 | 96 | WF | 67 | 59.0 | NC | 1,000 |  | Disc. | No | LW |
| 7,300 | 26.0 |  |  | Prim. |  |  | JS | 1,000 | 1,000 | Succ. |  |  |
| 1,260-1,650 | 25.0-26.0 | 5-24 | 95-103 | WF | 54.0 | 52-57 | NC | 2,300 | 0 | Disc. | Yes | FW |
| 7,400 | 38.0 | 1 | 141 | WF | 43 | 40.0 | HF | 573 | 9 | Disc. | Yes | FW |
| 800 | 30.3 | 10 | 80 | WF | 56 | 47.0 | HF | 1,270 | 72 | Succ. | Yes | FW |
| 2,880 | 38.7 | 3 | 100 | WF | 51 | 48.0 | HF | 975 | 50 | Succ. | Yes | FW |
| 6,000 | 40.0 |  | 160 | Prim. |  |  | NC | 16 | 16 | Disc. | No | P |
| 4,400 | 40.0 |  | 115 | Prim. |  |  | NC | 7 | 7 | Succ. | Yes | LW |
| 1,300 | 39.0 | 4.40 | 100 | WF | 50 |  | NC | 350 | 350 | Succ. |  | LW |

## Producing chemical EOR projects in U.S.—continued

| Operator | Field | State | County | Start date | Area, acres | – Number wells – | | Pay zone | Formation type | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Prod. | Inj. | | | | |
| Marathon Oil | Lawrence Robins 102 B Maraflood | Ill. | Lawrence | 8/82 | 25 | 12 | 5 | Bridgeport | S | 21.0 | 398 |
| Marathon Oil | Lawrence-Robins 202-B Project | Ill. | Lawrence. | 10/85 | 1 | 4 | 1 | Bridgeport Main | S | 20.6 | 352 |
| Marathon Oil | Main Consolidated M-1 Project | Ill. | Crawford | 2/77 | 407 | 34 | 27 | Robinson | S | 19.0 | 102 |
| Marathon Oil | Main Consolidated M-2 Project | Ill. | Crawford | 7/80 | 331 | 72 | 53 | Robinson | S | 19.0 | 150 |
| **Alkaline** | | | | | | | | | | | |
| Conoco | San Miguelito | Calif. | Ventura | 11/82 | 316 | 16 | 11 | Third Grubb | S | 15.1 | 36 |
| Shell | White Castle | La. | Iberville | 9/87 | 1 | 2 | 1 | Q RA SU | S | 31.0 | 1,000 |
| **Surfactant** | | | | | | | | | | | |
| South Fork Inc.' | S. Johnson | Ill. | Clark | 6/81 | 49 | 36 | 22 | Partlow | S | 18.3 | 302 |

Tables G, H, I, former operator: 'Tenneco †Celeron §Chevron *Texaco 'Gary ·DCR "Lawrence Allison

## Completed, terminated U.S. projects*

| Operator | Field | State | County | Start date | Area, acres | No. wells prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alkaline** | | | | | | | | | | | |
| Unocal | Carroll Unit | Tex. | Van Zandt | 11/81 | 212 | 4 | 0 | Lewisville | S | 26.0 | 100.0 |
| Unocal | South Van Unit | Tex. | Van Zandt | 9/80 | 800 | 9 | 4 | Lewisville | S | 26.0 | 100.0 |
| **$CO_2$ immiscible** | | | | | | | | | | | |
| Chevron | Heidelberg | Miss. | Jasper | 12/83 | 40 | 1 | 0 | Eutaw | S | 25.0 | 74.0 |
| Chevron | Pittsburg | Tex. | Camp | 11/83 | 40 | 1 | 0 | Sub-Clarksville | S | 23.0 | 460.0 |
| Exxon | Pewitt Ranch | Tex. | Titus | 6/83 | | 1 | | Paluxy | S | 24.0 | 1,000 |
| Shell | Weeks Island | La. | New Iberia | 1978 | 8 | 2 | 1 | S RES B | S | 26.0 | 1,800.0 |
| Union Pacific | Wilmington | Calif. | Los Angeles | 3/81 | 41 | 3 | 4 | Tar | S | 24.0 | 465.0 |
| Union Pacific | Wilmington | Calif. | Los Angeles | 2/84 | 156 | 10 | 12 | Tar | S | 24.0 | 465.0 |
| **$CO_2$ miscible** | | | | | | | | | | | |
| Amoco | Levelland | Tex. | Hockley | 8/78 | 15 | 1 | 4 | San Andres | Dolo. | 11.8 | 3.8 |
| Amoco | North Cowden Unit | Tex. | Ector | 6/85 | 12 | 2 | 6 | Grayburg | Dolo. LS | 10.0 | 5.4 |
| ARCO | North Coles Levee | Calif. | Kern | 6/81 | 70 | 7 | 1 | Stevens | S | 19.5 | 9.0 |
| Chevron | Kurten | Tex. | Brazos | 8/81 | 672 | 5 | 4 | Woodbine | S | 13.0 | 0.8 |
| Oxy USA | Welch | Tex. | Dawson | 2/82 | 2,675 | 140 | 119 | San Andres | LS | 9.3 | 9.0 |
| Pennzoil | Richardson | W.V. | Calhoun, Roane | 8/86 | 78 | 8 | 4 | Berea | S | 14.0 | 40.0 |
| Texaco | Bay St. Elaine | La. | Terrebonne | 1/81 | 9 | 0 | 0 | 8,000 ft | S | 32.9 | 1,480.0 |
| **Combustion** | | | | | | | | | | | |
| Oxy USA | Bellevue | La. | Bossier | 1971 | 180 | 186 | 48 | Nacatoch | S | 33.9 | 700.0 |
| **HC miscible** | | | | | | | | | | | |
| Callon Offshore* | Chandeleur Sound Block 25 | La. | St. Bernard | 1/83 | 342 | 8 | 3 | 4,800 ft sand | S | 21.3 | 1,980 |
| Callon Offshore* | Chandeleur Sound Block 25 | La. | St. Bernard | 1/83 | 941 | 40 | 16 | BB | S | 33.0 | 1,680 |
| **Hot water** | | | | | | | | | | | |
| Texaco | Midway-Sec 35 | Calif. | Kern | 3/87 | 10 | 16 | 6 | Potter | S | 35.0 | 2,000.0 |
| **Micellar/polymer** | | | | | | | | | | | |
| Oxy USA | Madison | Kan. | Greenwood | 8/82 | 40 | 15 | 16 | Bartlesville | S | 18.9 | 42.0 |
| Texaco | Salem Consolidated | Ill. | Marion | 8/81 | 60 | 20 | 12 | Benoist | S | 15.4 | 154.0 |
| Texaco | Sho-Vel-Tum | Okla. | Stephens | 8/83 | 9 | 3 | 3 | Sims | | 17.0 | 83.0 |
| **Microbial** | | | | | | | | | | | |
| John Brown E&C | Nav Pet. Res. 3-Teapot Dome | Wyo. | Natrona | 8/88 | 188 | 24 | 2 | Shannon | S | 18.0 | 4-650 |
| **Polymer** | | | | | | | | | | | |
| American Expl.† | Elaine (San Miguel) | Tex. | Dimmit | 12/81 | 1,260 | 11 | 0 | San Miguel | S | 21.7 | 6 |
| American Expl.† | Hospah Sand Unit | N.M. | McKinley | 1/83 | 1,061 | 31 | 16 | Upper Hospah | S | 24.7 | 467 |
| American Expl.† | S. Hospah Lower Oil Pool | N.M. | McKinley | 10/83 | 595 | 50 | 13 | Lower Hospah | S | 27.3 | 1,282 |
| ARCO | West Nelson Rozet | Wyo. | Campbell | 3/84 | 440 | 2 | 2 | Minnelusa | S | 17.0 | 170.0 |
| ARCO | West Rozet | Wyo. | Campbell | 9/84 | 120 | 3 | 2 | Minnelusa | S | 17.0 | 170.0 |
| Beard Oil Co.§ | Sleepy Hollow | Neb. | Red Willow | 2/85 | 1,600 | 41 | 10 | Reagan Sand | S | 24.0 | 2,900 |
| Chevron | C-Bar | Tex. | Crane | 6/83 | 2,600 | 56 | 32 | San Andres | Dolo. | 10.0 | 6.0 |
| Chevron | Dune | Tex. | Crane | 3/82 | 410 | 26 | 14 | San Andres | Dolo. | 14.0 | 28.0 |
| Chevron | Goldsmith 5600 | Tex. | Ector | 9/83 | 3,840 | 139 | 51 | Clearfork | Dolo. | 15.0 | 28.0 |
| Chevron | McElroy | Tex. | Crane | 10/82 | 3,200 | 242 | 56 | Grayburg | Dolo. | 13.0 | 6.0 |
| Chevron | N. Ward Estes | Tex. | Ward | 12/81 | 17,986 | 785 | 666 | Yates | S | 18.0 | 10.0 |
| Exxon | Camrick | Okla. | Beaver/Texas | 1984 | | 43 | 27 | Upper Morrow | S | 15.0 | |
| Exxon | Conroe | Tex. | Montgomery | 1985 | | | | 2B | S | | 5,500 |
| Exxon | Hewitt | Okla. | Carter | 3/81 | 886 | 85 | 52 | Hewitt | S | 21.0 | 175.0 |
| Exxon | Loudon | Ill. | Fayette | 1985 | | 760 | 554 | Chester | S | 19.0 | |
| Exxon | Omaha | Ill. | Gallatin | 1984 | | 15 | 4 | Chester | S | 18.0 | 20.0-387 |
| Exxon | Roland | Ill. | White/Gallatin | 1985 | | 12 | 8 | Chester | S | 19.5 | 13-279 |
| Exxon | Roland | Ill. | White | 1985 | | 16 | 14 | Chester | S | 15.7 | 16-626 |
| Exxon | Trapp | Kan. | Russell | 1984 | | 15 | 9 | Lansing/Kansas City | LS | 18.4 | |
| Exxon | W. Yellow Creek | Miss. | Wayne | 9/76 | 4,813 | 51 | 24 | Eutaw | S | 24.0 | 112.0 |
| Exxon | Webster | Tex. | Harris | 1985 | | 7 | 3 | Frio 1A | S | 28.0 | 208.0 |

Table I

| | Reservoir oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth, ft | Gravity, °API | cp | °F. | Previous prod. | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
| 950 | 29.0 | 18 | 70 | Prim./WF | 45 | | HF | 140 | 140 | Prom. | No | P (Exp. UL) |
| 900 | 29.0 | 18 | 70 | WF | 45 | | NC | 12 | 12 | Prom. | No | P (Exp. UL) |
| 1,000 | 36.0 | 6 | 70 | Prim./WF | 40 | | NC | 50 | 50 | Prom. | No | FW |
| 1,000 | 35.0 | 7 | 70 | Prim./WF | 40 | | HF | 65 | 65 | TETT | | FW |
| 8,011 | 31.0 | 0.70 | 205 | Prim. | 70 | 55.0 | HF | 1,025 | | TETT | | FW |
| 5,600-5,800 | 25.0 | 3.00 | 135 | | 22 | 11.0 | NC | | | Succ. | | P |
| 475 | 30.0 | 20.00 | 65 | WF | 46 | 28.0 | PP | 36 | 20 | Prom. | Yes | Exp. L |

Table J

| | Reservoir Oil | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth, ft | Gravity, °API | cp | °F. | Prev. prod. | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Project scope |
| 2,600 | 33.0 | 2.30 | 130.0 | WF | | | Term. | 5 | 0 | Disc. | Yes | FW |
| 2,600 | 35.0 | 2.30 | 130.0 | WF | | | Term. | 50 | 0 | Disc. | Yes | FW |
| 5,060 | 20.0 | 15.00 | 150.0 | Prim. | | | C | 24 | 0 | Disc. | No | P (Exp. UL) |
| 3,800 | 14.0 | 2,200.00 | 120.0 | Prim. | 65.0 | | C | 15 | 3 | Succ. | Yes | P |
| 4,500 | 19.0 | 30.00 | 160.0 | Prim. | | | C | | | Disc. | No | P |
| 12,760 | 32.0 | 0.50 | 225.0 | WF | 22.0 | 2.0 | C | 0 | 0 | Succ. | No | P. |
| 2,500 | 14.0 | 283.00 | 123.0 | WF | 51.0 | 30.0 | C | 50 | 50 | Succ. | No | P |
| 2,500 | 14.0 | 283.00 | 123.0 | WF | 51.0 | 30.0 | Term. | 250 | 250 | Succ. | No | FW |
| 4,900 | 30.0 | 2.30 | 105.0 | WF | 43.0 | | C | 0 | 0 | Succ. | | P (Exp. L) |
| 4,300 | 34.0 | 1.67 | 94.0 | WF | | | Term. | 20 | 20 | Disc. | | P |
| 9,000 | 36.0 | 0.45 | 235.0 | WF | 34.0 | 25.8 | Term. | 70 | 0 | Disc. | No | P (Exp. UL) |
| 8,300 | 38.0 | 0.40 | 230.0 | Prim. | 40.0 | | C | 118 | 0 | Succ. | | P |
| 4,890 | 34.0 | 2.15 | 96.0 | WF | 30.0 | 18.0 | Term. | 1,990 | 100 | TETT | No | |
| 2,300 | 46.0 | 3.00 | 80.0 | WF | 48.0 | | Term. | 80 | 40 | Prom. | No | P |
| 7,400 | 36.0 | 0.67 | 170.0 | Prim. | 20.0 | 5.0 | C | 10 | 10 | Disc. | No | FW |
| | 19.0 | 676.00 | 75.0 | Prim. | 72.0 | 32.0 | C | 0 | 0 | Succ. | Yes | FW |
| 4,800 | 27.0 | 3.50 | 120 | Prim. | 45 | 30.0 | C | 379 | 0 | Succ. | Yes | FW |
| 5,450 | 27.0 | 3.45 | 132 | Prim. | 45 | 30.0 | C | 2,104 | 0 | Succ. | Yes | FW |
| 1,600 | 12.0 | 38.00 | 200.0 | SF | | | Term. | 400 | 220 | TETT | Yes | P (Exp. L) |
| 1,900 | 38.0 | 2.90 | 97.0 | Prim. | 34.0 | | Term. | | | Disc. | No | P (Exp. UL) |
| 1,750 | 36.0 | 36.00 | 72.0 | WF | 30.5 | 15.3 | C | 110 | 110 | Prom. | No | P (Exp. UL) |
| 7,000 | 28.0 | 12.00 | 135.0 | WF | 50.0 | 45.0 | C | 30 | 30 | Disc. | No | P (Exp. UL) |
| 350 | 35.0 | 10.00 | 65.0 | Prim. | 45.0 | 45.0 | Term. | 391 | 0 | Disc. | | P |
| 4,450 | 36.0 | 3.00 | 140 | | 80.2 | 67.0 | Term. | 96 | 0 | Succ. | No | FW |
| 1,600 | 30.0 | 13.00 | 95 | WF | 69 | 68.2 | Term. | 148 | 0 | Succ. | No | FW |
| 1,600 | 24.0 | 35.00 | 95 | WF | 82.5 | 65.9 | Term. | 440 | 0 | Succ. | No | FW |
| 8,700 | 21.0 | 12.00 | 197.0 | WF | | | C | 100 | | Disc. | | P |
| 8,700 | 22.0 | 24.00 | 170.0 | WF | | | C | 70 | | Disc. | | P |
| 3,500 | 31.0 | 20.00 | 95 | WF | | | C | 1,600 | 800 | Succ. | Yes | FW |
| 3,500 | 36.0 | 5.00 | 107.0 | WF | 39.0 | | C | 220 | 0 | Succ. | Yes | FW |
| 3,350 | 32.0 | 3.50 | 95.0 | WF | 64.0 | | C | 176 | 0 | Succ. | Yes | FW |
| 5,600 | 32.0 | 3.50 | 100.0 | WF | 49.0 | | C | 1,180 | 350 | Succ. | Yes | FW |
| 2,800 | 32.0 | 2.70 | 88.0 | WF | 58.0 | | C | 4,600 | 0 | Succ. | Yes | FW |
| 2,600 | 33.0 | 1.50 | 95.0 | WF | 42.0 | | C | 5,364 | 0 | Succ. | Yes | FW |
| 7,530 | 39.0 | 1.50 | 142.0 | WF | | | C | | | Disc. | No | |
| 4,900 | | | 170.0 | Prim. | | | Term. | | | Disc. | No | P |
| 2,400 | 35.0 | 8.70 | 96.0 | WF | 43.0 | | C | | | Succ. | Yes | FW |
| 1,800 | 36.0 | 6.00 | 75.0 | WF | | | C | | | Disc. | | FW |
| 1,950 | 28.0 | 17.00 | 78 | WF | | | Term. | | | Disc. | | |
| 3,000 | 32.0 | 10.00 | 83 | WF | | | Term. | | | Disc. | | |
| 3,100 | 36.0 | 10.00 | 87 | WF | | | Term. | | | Disc. | | |
| 3,215 | 38.0 | 1.40 | 97.0 | WF | | | C | | | Disc. | Yes | LW |
| 4,950 | 20.0 | 20.00 | 150.0 | WF | 84.0 | 75.0 | C | | | Succ. | | FW |
| 5,900 | 29.0 | 1.30 | 165.0 | WF | | | C | | | Succ. | No | RW |

## Completed, terminated U.S. projects—continued

| Operator | Field | State | County | Start date | Area, acres | No. wells prod. | No. wells Inj. | Pay zone | Formation | Porosity, % | Permeability, md |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fina | Garza | Tex. | Garza | 10/82 | 120 | 10 | 5 | San Andres | LS | 19.8 | 4.1 |
| Fina | Westbrook | Tex. | Mitchell | 12/80 | 4,740 | 149 | 43 | Clearfork | Dolo. | 7.4 | 6.3 |
| Graham Resources | Carthage | Okla. | Texas | 12/82 | 1,640 | 14 | 9 | Morrow | S | 19.0 | 200.0 |
| Lamamco | Naval Reserve | Okla. | Osage | 2/82 | 3,360 | 90 | 28 | Bartlesville | S | 15.8 | 12.0 |
| Marathon Oil | Byron | Wyo. | Big Horn | 12/82 | 1,500 | 41 | 36 | Embar/Tensleep | LS/S | 13.9 | 4.5/78 |
| Mitchell Energy | Lucy N. | Tex. | Borden | 10/83 | 550 | 8 | 4 | Pennsylvanian | LS | 9.7 | 30.0 |
| Mobil | Salt Creek | Tex. | Kent | 12/84 | 12,100 | 185 | 92 | Canyon Reef | LS | 12.0 | 20.0 |
| Mobil | Vacuum | N.M. | Lea | 5/84 | 320 | 10 | 4 | San Andres | Dolo. | 10.4 | 3-100.0 |
| Oryx | Fitts | Okla. | Pontotoc | 1982 | 2,030 | 103 | 112 | Viola | LS | 13.6 | 1-36 |
| Oryx | Stephens County Regular | Tex | Stephens | 2/80 | 3,900 | 73 | 73 | Caddo | LS | 14.2 | 11.0 |
| Oryx | Stephens County Regular | Tex. | Stephens | 2/80 | 700 | 10 | 15 | Caddo | LS | 14.2 | 11.0 |
| Oryx | Stephens County Regular | Tex. | Stephens | 3/86 | 3,026 | 62 | 78 | Caddo | LS | 14.0 | 10.0 |
| Phillips | Vacuum | N.M. | Lea | 8/83 | 320 | 14 | 8 | San Andres | Dolo. | 11.5 | 17.0 |
| Prima Exploration | C-H | Wyo. | Campbell | 8/84 | 40 | 3 | 1 | Minnelusa | S | 20.6 | 80 |
| Shell | Big Mineral Creek-Barnes Sand | Tex. | Grayson | 12/84 | 1,065 | 14 | 18 | Barnes Sand | S | 18.5 | 59.0 |
| Shell | Big Mineral Creek-S Sand Unit | Tex. | Grayson | 5/85 | 1,600 | 22 | 14 | S Sand | S | 13.0 | 28.0 |
| Texaco | Carthage N.E. | Okla. | Texas | 4/83 | 1,024 | 7 | 4 | Morrow A | S | 18.6 | 92.0 |
| Texaco | Hewitt | Okla. | Carter | 8/82 | 300 | 5 | 5 | Hoxbar | S | 19.0 | 270.0 |
| Texaco | Hewitt | Okla. | Carter | 4/84 | 220 | 8 | 5 | Hoxbar | S | 21.0 | 84.0 |
| Texaco | Hewitt | Okla. | Carter | 11/85 | 100 | 6 | 3 | Lone Grove | S | 18.0 | 50.0 |
| Texaco | Sho-Vel-Tum | Okla. | Carter | 5/85 | 570 | 32 | 22 | Deese | S | 17.0 | 70.0 |
| Texaco | Sho-Vel-Tum | Okla. | Carter | 2/83 | 225 | 14 | 5 | Deese | S | 17.0 | 59.0 |
| Texaco | Sho-Vel-Tum | Okla. | Carter | 1/83 | 1,390 | 73 | 34 | Hoxbar Deese | S | 20.3 | 200.0 |
| Texaco | Sho-Vel-Tum | Okla. | Stephens | 8/81 | 190 | 7 | 4 | Deese | S | 17.4 | 216.0 |
| Texaco | Slaughter | Tex. | Cochran | 2/84 | 1,887 | 33 | 15 | San Andres | Dolo. | 11.2 | 6.0 |
| Texaco | Slaughter | Tex. | Cochran | 12/81 | 7,406 | 275 | 90 | San Andres | Dolo. | 10.7 | 3.0 |
| Texaco | Vacuum Grayburg-San Andres | N.M. | Lea | 7/82 | 1,486 | 37 | 29 | Grayburg/San Andres | Dolo. | 11.0 | 18.0 |
| Texaco | Black Diamond | Tex. | Jim Hogg | 4/83 | 200 | 4 | 3 | Pettus II | S | 25.0 | 212.0 |
| Unocal | Howard Glasscock | Tex. | Howard | 1/83 | 169 | 12 | 11 | Queen | S | 22.0 | 37.0 |
| Unocal | Southwest Van Unit | Tex. | Van Zandt | 9/84 | 529 | 18 | 20 | Lewisville | S | 26.0 | 100.0 |
| **Steam** | | | | | | | | | | | |
| Chevron | Cymric | Calif. | Kern | 5/66 | 26 | 18 | 0 | Tar | S | 32.0 | 1,200 |
| Chevron | Midway-Sunset. Sec. IF | Calif. | Kern | 2/78 | 19 | 23 | 8 | Upper 10-10 | S | 32.0 | 2,200 |
| Chevron | Tejon-Grapevine | Calif. | Kern | 12/78 | 40 | 6 | | Basal Chanac | | 30.0 | 2,160 |
| Mobil | Edison | Calif. | Kern | 12/81 | 100 | 11 | 0 | Kern River | S | 30.0 | 1,000.0 |
| Mobil | Kern Front | Calif. | Kern | 5/74 | 480 | 43 | 0 | Etchegoin | S | 37.0 | 1,000.0 |
| Texaco | Midway-Reward | Calif. | Kern | 2/77 | 10 | 36 | 0 | Potter | US | 33.0 | 3,000.0 |
| Texaco | Midway-Santiago Creek | Calif. | Kern | 12/83 | 10 | 10 | 4 | Tulare | US | 34.0 | 2,500.0 |
| Union Pacific | Wilmington | Calif. | Los Angeles | 7/82 | 20 | 9 | 4 | Tar | S | 30.1 | 2,780.0 |
| Unocal | Gato Ridge | Calif. | Santa Barbara | 1970 | 130 | 16 | 0 | Sisquoc Sib & S2 | S | 32.0 | 2,500 |
| Unocal | Midway-Sunset | Calif. | Kern | 1/85 | 5 | 9 | 4 | Potter | S | 34.5 | 3,700 |
| Unocal | South Belridge | Calif. | Kern | 3/85 | 167 | 12 | 0 | Tulare | S | 38.0 | 4,000.0 |
| Chevron | Cymric 62Z | Calif. | Kern | 2/86 | 30 | 31 | 19 | Tulare | S | 33.0 | 2,900 |
| Chevron | Lost Hills Sec. 32 | Calif. | Kern | 2/79 | 150 | 29 | | Etchegoin A | S | 36.0 | |
| Chevron | Lost Hills Sec. 32 | Calif. | Kern | 3/85 | 16 | 11 | 4 | Etchegoin A | S | 40.0 | 2,500 |
| Shell | Brea Olinda | Calfi. | Orange | 6/85 | 19 | 20 | 0 | Middle A Sand | S | 20.0 | 50-200 |
| Chevron | Kern Bluff | Calif. | Kern | 7/66 | 214 | 25 | | Santa Margarita | S | 29.0 | 2,000 |
| Shell | Midway-Sunset | Calif. | Kern | 6/86 | 110 | 37 | 0 | San Joaquin | S | 33.0 | |

Former operator:

* ARCO
† Tesoro
§ Amoco

## Producing Canadian heavy oil EOR projects

| Operator | Field | Province | Start date | Area, acres | – Number wells – Prod. | Inj. | Pay zone | Formation type | Porosity, % |
|---|---|---|---|---|---|---|---|---|---|
| **Combustion** | | | | | | | | | |
| Amoco Canada | Lindbergh Section 18 02 Pilot | Alta. | 12/82 | 10 | 6 | 1 | Lower Cummings B&C | US | 29.0 |
| Amoco Canada | Morgan | Alta. | 1/81 | | 35 | 9 | Lloydminster | US | 31.5 |
| **Electromagnetic** | | | | | | | | | |
| Mazzei Oil & Gas Ltd. | Frog Lake | Alta. | 1/89 | 640 | 4 | | Cummings, McLarin | S | 33.0 |
| **Steam** | | | | | | | | | |
| Amoco Canada | Cold Lake | Alta. | 1/85 | 50 | 16 | 16 | 20 meters | US | 33.0 |
| Amoco Canada | Soars Lake | Alta. | 6/88 | | 16 | | Sparky | US | 33.0 |
| Aostra | Athabasca Oil Sands | Alta. | 7/84 | 2 | 3 | 3 | McMurray | US | 30-35 |
| BP Resources Canada | Wolf Lake | Alta. | 4/85 | 10,130 | 396 | 396 | Clearwater FM | S | 31-33 |
| BP Resources Canada | Wolf Lake | Alta. | 1/88 | 4-6 | 22 | 22 | L. Grand Rapids FM (B) | S | 35.0 |
| Husky Oil | Pikes Peak | Sask. | 1/81 | 240 | 75 | 9 | Wasaca | US | 33.0 |
| Koch Exploration Canada | Fort Kent | Alta. | 12/85 | 160 | 13 | | Upper Grand Rapids | S | 35.0 |
| Mobil Oil Canada | Iron River | Alta. | 3/88 | 160 | 20 | 20 | Sparky | S | 30-35 |
| Mobil Oil Canada | Iron River/Wolf Lake | Alta. | 6/89 | | 1 | 1 | Grand Rapids-Gen. Petr | S | 35.0 |
| Murphy Oil | Lindbergh | Alta. | 1/74 | 212 | 68 | 68 | Lower Grand Rapids | US | 33.0 |
| Petro-Canada | Athabasca | Alta. | 1/87 | | 1 | 1 | McMurray | US | 32.0 |
| Petro-Canada | Athabasca | Alta. | 1/85 | | 1 | 1 | McMurray | US | 32.0 |
| Shell Canada Ltd. | Peace River | Alta. | 10/79 | 49 | 24 | 7 | Cretaceous-Bullhead | S | 28.0 |
| Shell Canada Ltd. | Peace River | Alta. | 10/86 | 450 | 163 | 53 | Cretaceous-Bullhead | S | 28.0 |
| Amoco Canada | Gregoire (Athabasca) | Alta. | 9/85 | | 3 | 1 | McMurray | US | 36.4 |
| Esso Resources Canada | Cold Lake | Alta. | 1964 | | 1,200 | 1,200 | Clearwater | US | 35.0 |

Table J

| Depth, ft | Reservoir Oil |  |  | Prev. prod. | Satur. % start | Satur. % end | Proj. matur. | Total prod., b/d | Enh. prod., b/d | Proj. eval. | Profit | Project scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gravity, °API | cp | °F. |  |  |  |  |  |  |  |  |  |
| 2,900 | 36.0 | 2.50 | 90.0 | WF | 40.0 |  | C | 680 |  | Disc. | Yes | P (Exp. UL) |
| 3,000 | 26.0 | 9.10 | 90.0 | WF | 50.0 |  | C | 15 |  |  | Yes |  |
| 4,500 | 39.0 |  | 119.0 | Prim./WF | 50.0 | 40.0 | C | 600 | 450 | Succ. | Yes | FW |
| 2,650 | 38.0 | 3.50 | 90.0 | WF | 27.2 | 26.7 | C | 463 | 15 | Succ. | Yes | FW |
| 5,600 | 23.0 | 17.00 | 121.0 | Prim./WF | 53.9 | 50.7 | C | 2,450 | 0 | Succ. | Yes | FW |
| 7,640 | 40.0 | 0.44 | 140.0 | Prim. | 52.6 | 35.7 | Term. | 95 | 15 | Disc. | No | FW |
| 6,300 | 39.2 | 0.85 | 129.0 | WF | 60.0 | 58.0 | C | 29,000 |  | Succ. | Yes | FW |
| 4,700 | 37.0 | 1.02 | 101.0 | Prim./WF | 38.0 | 30.0 | C | 240 |  |  | Yes | P (Exp. UL) |
| 3,900 | 39.0 | 3.20 | 119.0 | WF |  |  | C | 2,024 |  | Succ. | Yes | FW |
| 3,300 | 39.0 | 1.80 | 131.0 | WF |  |  | C | 1,555 |  | Succ. | Yes | FW |
| 3,300 | 39.0 | 1.80 | 131.0 | WF |  |  | C | 117 |  | Succ. | Yes | FW |
| 3,200 | 39.0 | 3.00 | 130.0 | WF |  |  | C | 1,031 |  | TETT |  | FW |
| 4,500 | 37.0 | 1.20 | 101.0 | Prim. | 74.9 | 58.2 | C | 1,000 |  | Succ. | Yes | LW |
| 7,500 | 20.7 | 26 | 135 | WF |  |  | Term. | 94 |  | Prom. |  | P (Exp. UL) |
| 5,000 | 37.0 | 1.50 | 120.0 | WF | 50.0 | 47.0 | Term. | 300 | 0 | Disc. | No | P (Exp. UL) |
| 5,200 | 37.9 | 1.67 | 124.0 | WF | 44.0 | 37.0 | Term. | 570 | 0 | Disc. | No | FW |
| 4,400 | 40.0 | 2.00 | 113.0 | WF | 45.0 | 44.5 | C | 209 | 60 | Succ. | Yes | FW |
| 2,350 | 35.0 | 6.00 | 98.0 | WF | 40.0 | 39.8 | C | 41 | 10 | Succ. | Yes | FW |
| 2,400 | 33.0 | 10.00 | 94.0 | WF | 39.0 | 37.0 | C | 102 | 46 | Succ. | Yes | FW |
| 4,000 | 30.0 | 4.30 | 115.0 | WF | 39.0 | 37.0 | C | 135 | 31 | Succ. | Yers | FW |
| 3,500 | 34.0 | 10.00 | 110.0 | Prim. | 57.0 | 54.6 | C | 1,059 | 320 | Succ. | Yes | FW |
| 4,400 | 20-34 | 4.30 | 102.0 | WF | 38.0 | 37.2 | C | 94 | 8 | Disc. | Yes | FW |
| 3,100 | 25.0 | 20.00 | 95.0 | WF | 49.0 | 47.8 | C | 1,520 | 200 | Succ. | Yes | FW |
| 5,500 | 22.0 | 60.00 | 124.0 | Prim. | 64.0 | 56.0 | C | 88 | 29 | Succ. | Yes | FW |
| 5,000 | 31.0 | 1.47 | 110.0 | WF | 53.0 | 50.0 | C | 291 | 0 | Disc. | Yes | FW |
| 5,000 | 31.0 | 1.47 | 107.0 | WF | 49.4 | 45.6 | C | 6,150 | 900 | Succ. | Yes | FW |
| 4,720 | 38.0 | 1.47 | 105.0 | WF | 45.0 | 44.0 | C | 3,650 | 182 | Succ. | Yes | FW |
| 4,550 | 48.0 | 0.40 | 164.0 | Prim. | 68.0 | 41.0 | C | 160 | 178 | Succ. | Yes | RW |
| 1,600 | 32.0 | 10.00 | 90.0 | WF | 50.7 | 43.4 | Term. | 62 | 25 | Succ. | Yes | FW |
| 2,600 | 35.0 | 2.30 | 130.0 | WF |  |  | Term. | 475 | 0 | Disc. | Yes | FW |
| 700 | 11.0 | 6,500.00 | 81.0 | Prim. | 60.0 | 20.0 | C | 332 | 273 | Succ. | Yes | FW |
| 1,600 | 14.0 | 1,500.00 | 105.0 | C | 55.0 | 15.0 | C | 100 | 0 | Succ. | Yes | FW |
| 2,600 | 16.0 | 167.0 | 115.0 | Prim. |  |  | Term. | 0 | 0 |  |  |  |
| 1,100 | 17.0 | 800.00 | 100.0 | Prim. | 87.0 | 33.0 | Term. | 30 | 20 | Succ. | Yes | FW |
| 1,200 | 14.0 | 800.00 | 100.0 | Prim. | 86.0 | 67.0 | Term. | 350 | 350 | Succ. | Yes | FW |
| 1,300 | 13.0 | 1,500.00 | 220.0 | S | 60.0 | 20.0 | Term. | 450 | 220 | Succ. | Yes | FW |
| 1,300 | 12.0 | 1,500.00 | 90.0 | S | 60.0 | 20.0 | Term. | 300 | 300 | Prom. | Yes | Exp. L |
| 2,563 | 14.0 | 283.00 | 123.0 | WF | 55.0 | 20.0 | C | 400 | 400 | Succ. | Yes | P (Exp. L) |
| 1,900 | 10.5 | 1,450 | 130 | Prim. | 65 | 49.0 | Term. | 60 | 5 | Disc. | No | FW |
| 1,100 | 11.4 | 10,000 | 110 | SF | 52 | 28.0 | C | 719 | 109 | Succ. | Yes | P (Exp. L) |
| 1,250 | 13.2 | 450.00 | 130.0 | Prim. | 66.0 | 52.0 | C | 103 | 0 | Disc. | No | FW |
| 1,200 | 12.0 | 5,500.00 | 100.0 | C | 51.0 | 15.0 | Term. | 130 | 0 | Succ. | Yes | FW |
| 1,150 | 18.0 | 200.00 | 90.0 | Prim. | 72.0 |  | Term. | 130 | 0 | Succ. | Yes |  |
| 850 | 14.0 | 1,400.00 | 100.0 | C | 50.0 | 20.0 | Term. | 100 | 0 | Succ. | Yes | FW |
| 3,000 | 13-16 | 200-600 | 100-140 | Steam soak | 49.0 |  | Term. | 220 | 280 | Succ. | Yes | FW |
| 950 | 15.0 | 1,000.00 | 84.0 | Prim. | 74.0 |  | Term. | 0 | 0 | Succ. | Yes |  |
| 1,200 | 12.0 | 2,900.00 | 95.0 | Prim. |  |  | Term. | 280 |  | Disc. |  |  |

Table K

| Permeability, md | Depth, ft | Reservoir oil |  |  | Satur. % start | Satur. % end | Project maturity | Total prod., b/d | Enh. prod., b/d | Project eval. | Profit | Project scope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | Gravity, °API | cp | °F. |  |  |  |  |  |  |  |  |
| 4,000 | 1,900 | 11.7 | 6,500 | 81 | 70 |  | HF |  |  | Prom. |  | P |
| 4,400 | 1,940 | 12.0 | 8,100 | 75 | 80 |  | HF |  |  | Succ. |  | P FW |
|  | 1,800 | 9-12 | 10,000 | 80 |  |  | HF | 220 | 80 | Prom. |  | Exp. L |
| 1,500 | 1,500 | 10.5 | 500,000 | 55 | 80 |  | HF |  |  | TETT |  | P |
| 5,000 | 1,490 | 11-13 | 5-10,000 | 70 | 78 |  | JS |  | 11 | Disc. | No | P(Exp. UL) |
| 0.1-10 | 500 | 8 | 10,000,000 | 50 | 85 | 15 | NC |  |  | Succ. | Yes | P |
| 1,000-3,000 | 1,600 | 10-12 | 30-230,000 | 60-61 | 54-66 |  | JS | 8,175 | 8,175 | Succ. |  | FW |
| 3,000 | 380 | 10 | 250-1,400,000 | 61 | 75 |  | JS |  |  | Disc. |  | P |
| 5,000-10,000 | 1,640 | 12 | 25,000 | 70 | 85 |  | HF | 4,400 | 4,400 | Succ. | Yes | Exp. L |
|  | 1,000 | 11 | 21,300 |  | 85 |  | HF |  |  | Prom. |  | P |
| 500-2,000 | 1,150 | 11.7 | 40,000 | 52 | 65 | 49 | JS | 850 | 850 | TETT |  | P |
| 1,000-4,000 | 1,250 | 11 | 50,000 | 15 | 70 |  | JS |  |  | TETT |  | P |
| 2,500 | 1,600 | 11 | 102,500 | 70 | 82 | 65 | PP | 2,500 | 2,500 | Prom. | Yes | Exp. L |
| 1,000-5,000 | 1,200 | 8-9 | 1,000,000 | 50 | 85 |  | NC |  |  | Prom. |  | P |
| 1,000-5,000 | 1,200 | 8-9 | 1,000,000 | 50 | 85 |  | NC |  |  | Prom. |  | P |
| 100-2,000 | 1,800 | 7.5 | 100,000 | 60 | 80 |  | NC | 1,000 |  | Succ. |  | P |
| 100-2,000 | 1,800 | 7.5 | 100,000 | 60 | 80 |  | JS | 10,000 |  | Succ. |  | Exp. L |
| 3,000 | 615 | 10 | 850,000 | 55 | 70 |  | HF |  |  | Succ. | No | P(Exp. UL) |
| 1,500 | 1,509 | 10.2 | 100,000 | 55 |  |  | HF | 88,060 |  | Succ. | Yes | FW |

Table 2

## Worldwide planned heavy oil projects

| Operator | Type project | Field | Country | Pay zone | Size, acres | Depth, ft | Gravity, °API | Start date |
|---|---|---|---|---|---|---|---|---|
| ARCO | Steam | Midway-Sunset | U.S., Calif. | Metson | 50 | 1,400 | 11 | 4/90 |
| BP Canada/Petro-Canada | Combustion | Wolf Lake | Canada, Alta. | Clearwater | 10 | 1,400 | 10-12 | 6/90 |
| Enercap | Steam | Camp Hill | U.S., Tex. | Carrizo | 35.75 | 450 | 18.5 | 3/90 |
| Husky Oil | Steam | Caribou Lake | Canada, Alta. | Clearwater | 100 | 1,500 | 11 | 11/90 |
| Pan Canadian | Electromagnetic | Frog Lake | Canada, Alta. | Cummings |  | 2,000 | 12 | 9/90 |
| Pan Canadian | Steam | Bodo | Canada, Alta. | McLaren |  | 3,000 | 12 | 9/90 |
| Pan Canadian | Steam | Lindbergh | Canada, Alta. | Cummings | 10 | 2,000 | 12 | 6/90 |
| Petro-Canada | Steam | Athabasca | Canada, Alta. | McMurray | 30 | 1,200 | 8-9 | 3/90 |

structure makes the expansion of $CO_2$ into other nearby fields relatively economical.

Half of the almost 30,000 bo/d increase in enhanced oil production from HC injection projects came from Prudhoe Bay. HC injection is the only EOR process active on the Outer Continental shelf.

### Future projects

In the U.S., 34 projects are planned for late 1989 through 1992. More than half, 18, are $CO_2$ projects. The largest in area, 23,000 acres, is Mobil Oil's planned project in the Postle field in Oklahoma's Texas County.

One large project in West Texas is the Shell Western E&P Inc. expansion of the $CO_2$ flood in the Wasson field's 28,758-acre Denver Unit. Two thirds of the unit is now under continuous $CO_2$ injection. This area will be converted to a water-alternating-gas injection (WAG), and the remaining one third of the unit will be put on continuous $CO_2$ injection followed by WAG at a later date.

Shell's Denver Unit is the largest $CO_2$ EOR project in the world in terms of production.

At the end of 1989, the unit was producing 41,100 bo/d of which 25,300 bo/d were considered enhanced recovery.

Internationally only nine projects are planned; six are in Canada. The largest in area, 4,000 acres, is Mobil Oil Canada's miscible $N_2$ project in the Carson Creek North field of Alberta.

Total planned expenditures through 1992 on these projects is estimated to be $502 million.

### Tax incentives

To spur on more EOR projects, the Texas legislature in 1989 reduced the oil severence tax from 4.6% to 2.7% for new tertiary recovery projects that started fluid injection after Sept. 1, 1989.

This reduced rate will be in effect for a 10-year period as long as the project remains active. The rate applies to all oil from the project and not just the incremental increase from enhanced recovery processes.

Not covered by this rate reduction are expansions of projects producing prior to Sept. 1, 1989; projects that are changed from one tertiary method to another; and pressure maintenance projects. ▪

# WORLDWIDE GAS PROCESSING

## *Capacities as of January 1, 1990, and average production*

| | | MMcfd | | Production—1,000 gal/day (Average based on the past 12 months) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | **No. plants** | **Gas capacity** | **Gas through-put** | **Ethane** | **Prop.** | **Isobut.** | **Process or unsplit butane** | **LP-gas mix** | **Raw NGL mix** | **Debut. nat. gaso.** | **Other** | **Total products** |
| **United States** | | | | | | | | | | | | |
| Alabama | 7 | 255.0 | 200.7 | .... | 164.3 | .... | 129.1 | 6.4 | 39.9 | 93.2 | 434.7 | 867.6 |
| Alaska | 4 | 4,073.5 | 3,946.0 | .... | 2.6 | .... | .... | .... | 2,356.6 | .... | .... | 2,359.2 |
| Arkansas | 4 | 933.0 | 578.4 | 0.3 | 7.5 | 1.6 | 6.5 | .... | 48.8 | 6.0 | 3.0 | 73.7 |
| California | 34 | 1,032.7 | 655.3 | .... | 416.0 | 36.8 | 245.6 | 77.0 | 331.2 | 83.2 | 11.4 | 1,201.2 |
| Colorado | 42 | 1,101.5 | 687.8 | 63.1 | 248.0 | .... | 98.9 | 44.4 | 655.8 | 57.6 | 18.3 | 1,186.1 |
| Florida | 2 | 890.0 | 755.0 | 71.1 | 115.8 | 22.0 | 79.0 | .... | .... | 70.1 | .... | 358.0 |
| Kansas | 25 | 5,448.1 | 3,786.1 | 360.2 | 937.0 | 95.5 | 408.5 | 47.2 | 378.2 | 302.7 | 1.9 | 2,531.2 |
| Kentucky | 2 | 71.0 | 45.6 | .... | .... | .... | .... | .... | 117.5 | .... | .... | 117.5 |
| Louisiana | 80 | 18,720.5 | 11,059.8 | 1,152.6 | 1,094.5 | 344.5 | 361.0 | 35.5 | 5,698.3 | 668.3 | 320.1 | 9,674.8 |
| Michigan | 31 | 4,824.1 | 1,703.9 | .... | 24.6 | .... | .... | 61.6 | 665.1 | 15.0 | 38.4 | 804.7 |
| Mississippi | 7 | 902.2 | 373.7 | .... | 9.3 | .... | 8.0 | .... | 15.8 | 9.1 | 2.3 | 44.5 |
| Montana | 7 | 27.0 | 10.6 | .... | 29.6 | 6.8 | 5.0 | 17.7 | 18.2 | 11.1 | 1.0 | 89.4 |
| Nebraska | 1 | 1.5 | 0.9 | .... | .... | .... | .... | .... | 0.4 | .... | .... | 0.4 |
| New Mexico | 28 | 3,176.0 | 2,210.4 | 160.4 | 130.6 | 11.5 | 41.9 | 34.3 | 4,633.9 | 44.0 | 35.3 | 5,091.9 |
| North Dakota | 8 | 165.0 | 108.9 | .... | 150.4 | .... | 84.1 | .... | 113.4 | 23.6 | 13.2 | 384.7 |
| Oklahoma | 103 | 4,433.5 | 2,644.7 | 782.2 | 679.3 | 100.4 | 259.8 | 188.4 | 4,230.5 | 303.9 | 220.9 | 6,765.4 |
| Pennsylvania | 2 | 14.0 | 8.3 | .... | 4.7 | .... | 3.0 | .... | .... | 4.1 | .... | 11.8 |
| Texas | 315 | 16,621.4 | 10,691.3 | 3,477.7 | 3,325.5 | 563.5 | 1,544.1 | 3967.7 | 15,270.6 | 2,249.6 | 1,420.1 | 28,247.8 |
| Utah | 12 | 537.5 | 266.9 | .... | 95.6 | .... | 22.8 | .... | 135.1 | 43.8 | 1.7 | 299.0 |
| West Virginia | 7 | 397.0 | 324.9 | 235.6 | 143.7 | 24.1 | 44.8 | 88.2 | 256.2 | .... | .... | 792.6 |
| Wyoming | 40 | 3,489.5 | 2,687.0 | .... | 236.8 | 10.8 | 155.5 | 73.5 | 2,518.4 | 135.1 | 257.4 | 3,387.5 |
| **Total U.S.** | **761** | **67,114.0** | **42,756.2** | **6,303.2** | **7,815.8** | **1,217.5** | **3,497.6** | **1,070.9** | **37,483.9** | **4,120.4** | **2,779.7** | **54,289.0** |
| Abu Dhabi | 5 | 1,602.0 | 1,269.0 | .... | .... | .... | .... | .... | .... | 546.0 | .... | 546.0 |
| Algeria | 4 | 5,335.2 | 4,268.2 | .... | .... | .... | .... | 632.8 | .... | .... | 5,449.2 | 6,082.0 |
| Argentina | 14 | 1,488.4 | 1,498.9 | 687.7 | 497.2 | .... | 334.8 | .... | .... | 319.8 | 0.8 | 1,840.3 |
| Australia | 5 | 2,573.0 | 1,376.0 | 279.0 | 441.0 | .... | 249.0 | 610.3 | .... | 1,058.5 | 850.0 | 3,487.8 |
| Austria | 1 | 17.5 | 13.7 | .... | .... | .... | .... | 26.7 | .... | 28.4 | .... | 55.1 |
| Bahrain | 1 | 168.0 | 155.0 | .... | .... | .... | .... | 25.6 | .... | .... | .... | 25.6 |
| Bangladesh | 2 | 240.0 | 178.0 | .... | .... | .... | .... | .... | .... | .... | 8.2 | 8.2 |
| Bolivia | 2 | 474.0 | 177.3 | .... | 1.4 | 2.5 | .... | 161.7 | .... | 61.5 | 136.9 | 364.0 |
| Brazil | 11 | 449.7 | 433.6 | 0.9 | .... | .... | .... | 519.1 | 209.6 | 135.3 | 9.6 | 874.5 |
| Brunei | 2 | 1,032.0 | 832.4 | .... | 9.4 | .... | .... | .... | 50.1 | 252.1 | .... | 311.6 |
| Canada | | | | | | | | | | | | |
| Alberta | 473 | 22,630.2 | 14,033.4 | 6,419.9 | 3,248.3 | 870.4 | 814.2 | 1,214.8 | 4,160.0 | 4,123.1 | 671.4 | 21,522.1 |
| British Columbia | 14 | 1,780.3 | 856.5 | .... | 192.5 | .... | 65.9 | 3.5 | .... | 31.0 | .... | 292.9 |
| Northwest Territories | 2 | 219.9 | 28.3 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Saskatchewan | 23 | 295.4 | 194.3 | .... | .... | .... | .... | 12.9 | 104.7 | 0.3 | 18.0 | 135.9 |
| Chile | 2 | 470.0 | 423.0 | .... | 190.0 | .... | 120.0 | .... | .... | 106.0 | .... | 416.0 |
| China, Taiwan | 4 | 270.3 | 60.3 | 13.2 | 26.4 | 0.8 | 16.8 | .... | 8.7 | .... | 12.3 | 78.2 |
| Colombia | 6 | 348.0 | 218.0 | 132.8 | 52.0 | .... | 58.5 | 43.5 | .... | 70.7 | 1.1 | 358.6 |
| Denmark | 1 | 450.0 | 240.0 | .... | .... | .... | .... | .... | .... | .... | 100.0 | 100.0 |
| Dominican Republic | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 277.2 | 277.2 |
| Dubai | 1 | 330.0 | 330.0 | .... | .... | .... | .... | .... | .... | .... | 650.5 | 650.5 |
| Ecuador | 2 | 41.0 | 20.5 | .... | .... | .... | .... | 97.1 | .... | 37.3 | .... | 134.4 |
| Egypt | 8 | 1,320.0 | 1,188.0 | .... | .... | .... | .... | 691.7 | .... | .... | 1,158.5 | 1,850.2 |
| France | 1 | 570.0 | 563.0 | .... | 139.0 | .... | 132.0 | .... | .... | 270.0 | .... | 541.0 |
| Germany | 3 | 366.0 | 274.0 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Greece | 2 | 39.0 | 31.2 | .... | .... | .... | .... | .... | 72.0 | .... | .... | 72.0 |
| Hungary | 12 | 1,097.2 | 475.3 | .... | 65.7 | 6.3 | 70.0 | .... | 367.4 | 819.2 | 103.6 | 1,432.2 |
| Indonesia | 10 | 3,900.5 | 3,496.2 | 17.3 | 345.6 | 113.4 | 0.9 | 51.6 | 1,462.4 | 24.0 | 5.2 | 2,020.4 |
| Italy | 17 | 7,614.0 | 1,587.0 | .... | .... | .... | .... | 2.7 | 8.0 | 7.5 | .... | 18.2 |
| Kuwait | 1 | 1,815.0 | 1,452.0 | .... | 1,722.0 | .... | 980.0 | .... | .... | 811.8 | .... | 3,513.8 |
| Libya | 7 | 1,851.0 | 1,227.0 | .... | .... | .... | .... | 37.8 | 5,577.0 | .... | 551.0 | 6,165.8 |
| Malaysia | 2 | 282.0 | 105.0 | 161.4 | 23.2 | 136.3 | 28.2 | .... | .... | 154.1 | .... | 503.2 |
| Mexico | 11 | 4,649.0 | 3,370.4 | 12,704.9 | .... | .... | .... | .... | .... | .... | 9.5 | 12,714.4 |
| Netherlands | 1 | 350.0 | 35.0 | .... | .... | .... | .... | .... | .... | .... | 4.2 | 4.2 |
| New Zealand | 6 | 1,152.0 | 533.0 | .... | 39.1 | .... | 1.8 | 134.7 | .... | 18.6 | 733.7 | 927.9 |
| Norway | 2 | 950.0 | 507.0 | .... | 682.0 | 108.0 | 256.0 | .... | 200.0 | 193.0 | .... | 1,439.0 |
| Oman | 8 | 626.0 | 309.4 | .... | .... | .... | .... | .... | 202.0 | 43.0 | .... | 245.0 |
| Pakistan | 7 | 430.0 | 187.7 | .... | .... | .... | .... | 48.8 | 6.1 | .... | 9.1 | 64.0 |
| Peru | 2 | 70.0 | 37.0 | .... | 3.4 | .... | 1.0 | 5.6 | 28.9 | .... | 4.0 | 42.9 |
| Qatar | 2 | 579.0 | 232.0 | .... | 434.6 | .... | 255.5 | .... | .... | 173.0 | .... | 863.1 |
| Saudi Arabia | 5 | 4,300.0 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Sharjah | 2 | 990.0 | 925.0 | .... | 290.0 | .... | 214.0 | .... | .... | .... | 1,239.0 | 1,743.0 |
| Spain | 3 | 428.0 | 177.0 | .... | .... | .... | .... | .... | .... | .... | 73.0 | 73.0 |
| Thailand | 2 | 850.0 | 550.0 | .... | .... | .... | .... | 400.4 | 8.4 | 84.0 | .... | 492.8 |
| United Kingdom | 9 | 3,732.0 | 1,537.0 | .... | 332.0 | .... | 291.0 | .... | 150.0 | 1,748.5 | 51.8 | 2,573.3 |
| Venezuela | 14 | 2,913.0 | 2,557.0 | 213.3 | 197.4 | .... | 113.4 | 231.3 | 3,274.6 | 171.9 | .... | 4,201.9 |
| Yemen | 1 | 400.0 | 324.0 | .... | .... | .... | .... | .... | 120.0 | 189.0 | .... | 309.0 |
| **Total, outside U.S.** | **712** | **81,488.6** | **48,286.6** | **20,630.4** | **8,932.2** | **1,237.7** | **4,003.0** | **4,952.6** | **16,009.9** | **11,477.6** | **12,127.8** | **79,371.2** |
| **World Total** | **1,473** | **148,602.6** | **91,042.8** | **26,933.6** | **16,748.0** | **2,455.2** | **7,500.6** | **6,023.5** | **53,493.8** | **15,598.0** | **14,907.5** | **143,660.2** |

| | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| **ALABAMA** | | | | | | | | | | | |
| Collet Ventures Inc.—Copeland Washington Co. | 12.0 | 6.0 | $^{13}$2-$^{7}$5-7 | .... | .... | .... | .... | 6.4 | .... | 16.6 | .... |
| Exxon Co. USA—Big Escambia Creek, Escambia Co., 4-1n-7e | 40.0 | 35.2 | 6-7 | .... | 53.7 | .... | 43.7 | .... | .... | 23.3 | .... |
| FMP Operating Co.—Womack Hill, Choctaw Co., 9-10n-2w | 4.0 | 2.4 | 3 | .... | 6.6 | .... | 7.2 | .... | .... | 4.6 | .... |
| Four Star Oil & Gas, Division of Texaco Inc.—*Hatter's Pond, Mobile Co., 10-2s-1w | 35.0 | 45.5 | 3 | .... | 55.0 | .... | 41.0 | .... | .... | 23.1 | $^{11}$434.7 |
| Mobil Oil Exploration & Producing Southeast Inc.—Mary Ann, Mobile Co., 34-75-2w | 80.0 | 35.4 | $^{33}$1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Phillips Petroleum Co.—Chatom, Washington Co., ne4-29-6n-4w | 27.0 | 27.2 | 3 | .... | .... | .... | .... | .... | 39.9 | .... | .... |
| Unocal—*Chunchula, Mobile Co., 22-1s-2w | 57.0 | 49.0 | 3 | .... | 49.0 | .... | 37.2 | .... | .... | 25.6 | .... |
| **Total** | **255.0** | **200.7** | | .... | **164.3** | .... | **129.1** | **6.4** | **39.9** | **93.2** | **434.7** |
| **ALASKA** | | | | | | | | | | | |
| Arco Alaska Inc.—*Prudhoe Bay | 3,300.0 | 3,300.0 | 3 | .... | .... | .... | .... | .... | 2,140.0 | .... | .... |
| Lisburne Production Center, 11n-15e-19 | 460.0 | 345.0 | 3 | .... | .... | .... | .... | .... | 200.0 | .... | .... |
| *Swanson River LTS, Kenai Borough, 4-7n-9w | 310.0 | 300.0 | 3 | .... | 2.6 | .... | .... | .... | 16.5 | .... | .... |
| Unocal—Granite Point, Kenai Peninsula, 28-11n-12w | 3.5 | 1.0 | 3 | .... | .... | .... | .... | .... | <0.1 | .... | .... |
| **Total** | **4,073.5** | **3,946.0** | | .... | **2.6** | .... | .... | .... | **2,356.6** | .... | .... |
| **ARKANSAS** | | | | | | | | | | | |
| Amoco Production Co.—*Chalybeat Springs, Columbia Co., 34-19s-19w | 28.0 | 24.0 | 7 | .... | .... | .... | .... | .... | 20.7 | .... | .... |
| Associated Natural Gas Inc.—Walker Creek, Columbia Co., 24-19s-23w | 30.0 | 27.3 | $^{19}$2 | 0.3 | 4.5 | 1.6 | 2.5 | .... | 6.9 | .... | .... |

## Gas Processing Survey

To arrive at more accurate totals, natural-gas throughput and liquids production are estimated at 80% capacity in those cases where only capacities are available. This explains apparent discrepancies in the addition of some columns.

The letters NR mean no response.

*Indicates cycling operations.

The symbol < denotes less than 100 gal/day.

The process/conditioning methods in the third column are identified by the following numbers:

1—absorption
2—refrigerated absorption
3—refrigeration
4—compression
5—adsorption
6—cryogenic-Joule-Thomson
7—cryogenic-expander
8—stabilization

Agents used in processes 1, 2, and 5 are indicated by superscripts as follows:

$^{1}$absorption oil
$^{2}$activated alumina
$^{3}$amine
$^{4}$anhydrous ammonia
$^{5}$Asorball
$^{6}$coal
$^{7}$DEA
$^{8}$desiccant
$^{9}$DGA
$^{10}$diesel-No. 1
$^{11}$ep naphtha
$^{12}$freon
$^{13}$glycol
$^{14}$hot potassium carbonate
$^{15}$iron sponge
$^{16}$Jet A
$^{17}$kerosine
$^{18}$kero-propane
$^{19}$lean oil
$^{20}$MDEA,
$^{21}$Mea,
$^{22}$mineral seal oil
$^{23}$mole sieve
$^{24}$naphtha
$^{25}$natural gasoline
$^{26}$propane
$^{27}$Purisol
$^{28}$Q-Sol
$^{29}$Selexol
$^{30}$Sepasolv
$^{31}$silica gel
$^{32}$Sorbead
$^{33}$Sulfinol
$^{34}$Sulphalene
$^{35}$TEG
$^{36}$Varsol
$^{37}$mw100
$^{38}$mw110
$^{39}$mw115
$^{40}$mw120
$^{41}$mw125
$^{42}$mw127
$^{43}$mw130
$^{44}$mw131
$^{45}$mw133
$^{46}$mw140
$^{47}$mw145
$^{48}$mw150
$^{49}$mw160
$^{50}$mw175

Products listed in the last column are identified by numbers:

1—isopentane
2—upgraded motor fuel
3—diesel
4—kerosine
5—ethane-propane mix
6—solvent naphtha
7—jet fuel
8—normal pentane
9—residuum, bottoms
10—distillate, fuel oil
11—condensate
12—gas oil.

Figures in parentheseis do not represent primary production, and are not added in state totals.

Since this compilation includes cycling plants reprocessing pipeline gas, totals shown here for gas throughput do not relate directly to government data on total gas processed, or sold. Similarly, liquids production figures are based on yearly average and do not necessarily reconcile with government data.

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Natural Gas Pipeline Co. of America—DP 370, White County, 29-7n-7w | 850.0 | 505.0 | 3 | .... | .... | .... | .... | .... | 21.2 | .... | .... |
| Oxy NGL Inc.—*Walker Creek, Columbia Co., 23-19s-23w | 25.0 | 22.1 | 2 | .... | 3.0 | .... | 4.0 | .... | .... | 6.0 | [11]3.0 |
| **Total** | **933.0** | **578.4** |  | **0.3** | **7.5** | **1.6** | **6.5** | .... | **48.8** | **6.0** | **3.0** |

## CALIFORNIA

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ARCO Oil & Gas Co.—No. Coles Levee No. 8, Kern Co., 32-305-25e MDB&M | 20.0 | 10.2 | [26]2 | .... | 21.3 | 5.6 | 15.1 | .... | .... | 13.3 | .... |
| Ojai Timber No. 16, Ventura Co., Rancho Ojai 36 | 3.0 | 2.1 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Chevron USA Inc.—Carpinteria, Santa Barbara Co., 33-4n-25w | 30.0 | 16.4 | 3 | .... | 0.6 | .... | 3.2 | .... | .... | 3.9 | .... |
| Huntington Beach, Orange Co., 3-6s-11w | 3.5 | 1.8 | 3 | .... | .... | .... | .... | .... | 2.7 | .... | .... |
| Inglewood LTS, Los Angeles Co., 8-25-4w | 15.0 | 5.8 | 3 | .... | .... | .... | .... | .... | 12.8 | .... | .... |
| Kettleman 3-P, Kings Co., 3-22s-17e | 10.0 | 4.7 | 3 | .... | .... | .... | .... | .... | 6.4 | .... | .... |
| McKittrick Seventeen-Z, Kern Co., 17-30s-22e | 80.0 | 47.3 | 1-[26]2 | .... | 35.6 | .... | .... | .... | 40.8 | .... | .... |
| Murphy-Coyote, Orange Co., 18-3s-10w | 5.0 | 1.0 | 3 | .... | .... | .... | .... | .... | 1.3 | .... | .... |
| Race Track 32-Z, Kern Co., 32-30s-29e | 7.0 | 0.3 | 3 | .... | .... | .... | .... | .... | 0.2 | .... | .... |
| Taft 1-C LTS, Kern Co., 1-32s-23e | 16.0 | 9.5 | 3 | .... | 1.3 | .... | 3.8 | .... | .... | 11.3 | .... |
| Torrance, Los Angeles Co., 24-4s-14w | 3.0 | 0.6 | 3 | .... | .... | .... | .... | .... | 0.8 | .... | .... |
| Department of Energy—35R, Kern Co., 30s-23e-35-R | 94.0 | 75.5 | [1]1 | .... | 49.1 | .... | 46.2 | .... | 44.7 | .... | .... |
| LTS-1, Kern Co., 30s-23e-35R | 100.0 | 128.1 | 3 | .... | 77.1 | .... | 70.2 | .... | 66.3 | .... | .... |
| LTS-2, Kern Co., 30s-23e-35R | 100.0 | 130.9 | 3 | .... | 84.6 | .... | 66.4 | .... | 65.8 | .... | .... |
| Four Star Oil & Gas, Division of Texaco Inc.—Lost Hills, Kern Co., 9-27s-21e | 60.0 | 22.0 | 3 | .... | 12.8 | .... | .... | .... | 27.2 | .... | .... |
| Lomita Gasoline Co.—Harbor, Los Angeles Co. | 60.0 | 10.0 | 4 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Signal Hill, Los Angeles Co. | 20.0 | 5.0 | 3,4 | .... | 2.1 | .... | .... | .... | 16.0 | .... | .... |
| Marathon Oil Co.,—South Coles Levee, Kern Co., 3-31s-25e | 80.0 | 25.0 | 1-[1]5 | .... | 9.0 | 1.4 | 2.6 | .... | .... | 6.8 | .... |
| Mobil Oil Corp.—Rincon, Ventura Co., 7-3n-24w SBB&M | 20.0 | 8.0 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]11.0 |
| Shell Western E&P Inc.—Clark Ave., Santa Barabara Co., 9-9n-33w | 3.6 | 1.0 | 3 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| Huntington Beach, Orange Co., 3-6s-11w | 15.0 | 2.8 | 3 | .... | .... | .... | .... | 7.9 | .... | .... | .... |
| Kernridge, Kern Co., 32-28s-1e | 60.0 | 50.4 | 2 | .... | 27.7 | 23.7 | .... | 56.7 | .... | .... | .... |
| Molino, Santa Barbara Co., 31-5n-31w | 20.0 | 0.3 | 2 | .... | <0.1 | .... | .... | 0.3 | .... | .... | .... |
| Texaco Inc.—Buena Vista Hills, Kern Co., 8-32s-24e MDB&M | 20.0 | 6.8 | [19]1 | .... | 6.6 | .... | .... | .... | 8.5 | .... | .... |
| Cymric, Kern Co., 26-29s-22e MDB&M | 2.0 | 1.0 | 3 | .... | .... | .... | .... | .... | 1.7 | .... | .... |
| Montebello, Los Angeles Co. | 2.0 | 0.2 | 3 | .... | .... | .... | .... | .... | <0.1 | .... | .... |
| Shiells Canyon, Ventura Co., 4-4n-19w-SBBM | 18.0 | 7.0 | [19]2 | .... | 6.5 | .... | 4.7 | .... | 6.8 | .... | .... |
| Ventura Co., 27-3n-23w SBB&M | 20.0 | 13.7 | [19]2 | .... | 23.4 | 6.1 | 12.4 | .... | .... | 9.8 | .... |
| Unocal—Battles, Santa Barbara Co., 24-10n-34w SBB&M | 35.0 | 8.5 | [48]1 | .... | 19.0 | .... | 14.2 | .... | .... | 11.0 | .... |
| Bell, Los Angeles Co., 6-3s-11w, SBB&M | 0.6 | 0.4 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]0.4 |
| Coalinga Nose, Fresno Co., 7-20s-16e, SBB&M | 70.0 | 52.5 | 7 | .... | 32.6 | .... | 6.8 | .... | .... | 21.7 | .... |
| Dominguez, Los Angeles Co., 33-3s-9w SBB&M | 3.0 | 1.9 | 2 | .... | .... | .... | .... | .... | 3.4 | .... | .... |
| Santa Clara Valley, Ventura Co., 31-4n-18w, SBB&M | 17.0 | 8.5 | 7 | .... | .... | .... | .... | 12.1 | .... | 5.4 | .... |
| Stearns, Orange Co., 7-3s-9w SBB&M | 20.0 | 6.1 | [48]1 | .... | 6.6 | .... | .... | .... | 20.7 | .... | .... |
| **Total** | **1,032.7** | **665.3** |  | .... | **416.0** | **36.8** | **245.6** | **77.0** | **331.2** | **83.2** | **11.4** |

## COLORADO

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Production Co.—Spindle, Weld Co., 34-2n-67w | 37.0 | 23.0 | 7 | .... | .... | .... | .... | .... | 95.5 | .... | [11]5.5 |
| Wattenberg, Adams Co., 32-3s-65w | 150.0 | 70.0 | 7 | .... | .... | .... | .... | .... | 170.1 | .... | .... |
| Associated Natural Gas Inc.—Eaton, Weld Co., se 34-7n-66w | 15.0 | 9.3 | 3 | 11.7 | 13.0 | .... | 8.2 | .... | .... | 4.7 | .... |
| Greeley, Weld Co., sw 25-5n-66w | 25.0 | 21.7 | 3-6 | 20.7 | 23.5 | .... | 14.6 | .... | .... | 9.0 | .... |
| Kersey, Weld Co., se 35-4n-66w | 35.0 | 28.4 | 3 | 19.6 | 24.5 | .... | 24.0 | .... | .... | 8.3 | .... |
| Lucerne, Weld Co.,se 28-6n-65w | 15.0 | 12.1 | 3-6 | 11.5 | 14.1 | .... | 9.5 | .... | .... | 4.7 | .... |
| Brighton Gas Processors—Brighton, Weld Co., se4 se4 28-1n-67w 6th PM | 2.5 | 1.2 | 3 | .... | .... | .... | .... | .... | 2.7 | .... | [11]<0.1 |
| Cabin Creek Gas—Cabin Creek, Adams Co., sw4 nw4 31-3s-59w 6th PM | 1.5 | 0.1 | 3 | .... | .... | .... | .... | .... | 1.6 | .... | .... |
| Celsius Energy Co.—Dove Creek, Dolores Co., 5-40n-18w | 10.0 | 2.5 | 3 | .... | .... | .... | .... | .... | 0.3 | .... | .... |
| Cutthroat 'A', Montezuma Co.,10-37n-19w | 2.5 | 1.5 | 3 | .... | .... | .... | .... | .... | 8.0 | .... | .... |
| Cutthroat 'B', Montezuma Co.,26-37n-19w | 2.5 | 1.5 | 3 | .... | .... | .... | .... | .... | 8.0 | .... | .... |
| Chevron USA Inc.—Rangely $CO_2$, Rio Blanco, 32-2n-102w | 60.0 | 60.0 | 3 | .... | .... | .... | .... | .... | 50.4 | .... | [11]8.4 |
| Conoco Inc.—Dragon Trail, 35, t2s-102w | 56.0 | 30.0 | [19]2-3 | .... | 17.5 | .... | .... | .... | 27.8 | .... | [11]1.5 |
| Coors Energy Co.—Wattenberg, Weld Co., 25-1n-68w | 8.5 | 6.0 | 3 | .... | .... | .... | .... | .... | 6.0 | .... | .... |
| Enron Gas Processing Co.—Greeley, Weld Co., sw 25-5n-6w | 5.5 | 1.8 | 3 | .... | 2.0 | .... | .... | .... | 2.2 | .... | [11]0.2 |
| Four H Partnership—Piceance Creek, Rio Blanco Co., 15-25-96w (25 miles se of Rangely) | 40.0 | 15.0 | [1]2 | .... | 6.0 | .... | .... | .... | 6.0 | .... | .... |
| Gary-Williams Energy Corp.—Running Creek Elbert Co., 21-6s-64w | 5.0 | 3.3 | 3 | .... | .... | .... | .... | 16.3 | .... | .... | .... |
| Greeley Gas Co.—Clyde, Prowers Co., 25-t23s-r44w.. | 5.0 | 4.0 | 3 | .... | .... | .... | .... | .... | 2.7 | .... | .... |

| Company, plant, location | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Koch Hydrocarbon Co.—Third Creek, Adams Co., 18-25-65w | 25.0 | 14.8 | 2 | .... | 16.9 | .... | .... | .... | 52.6 | .... | [11]2.5 |
| Loveland Gas Processing Co. Ltd.—*Loveland, Larimer Co., t5n, r68w | 6.0 | 2.0 | 3 | .... | 2.8 | .... | .... | .... | .... | †3.5 | .... |
| McMoRan Oil & Gas Co.—Yenter, Logan Co., nw¼ 2-8n-54w | 8.0 | 3.1 | [1]2 | .... | 6.7 | .... | .... | 5.8 | .... | .... | .... |
| Northwest Pipeline Corp.—Foundation Creek, *Rio Blanco Co., 26-45n-102w | 20.0 | 5.0 | 3 | .... | .... | .... | .... | .... | 2.4 | .... | .... |
| Ignacio, La Plata Co., sw¼ 36-34n-114w | 300.0 | 242.0 | 7 | .... | 58.2 | .... | 42.6 | .... | 85.4 | 27.4 | .... |
| North Douglas Creek, Rio Blanco Co., 19-1s-101w | 20.0 | 11.0 | 3 | .... | .... | .... | .... | .... | 9.8 | .... | .... |
| Oryx Energy Co.—Denver Central, Arapahoe Co., 5-5s-62w | 12.0 | 4.8 | [19]2 | .... | 14.9 | .... | .... | .... | 12.8 | .... | .... |
| Ralston Processing Associates Inc.—*McClave, Kiowa Co., 32-20s-48w | 7.5 | 2.1 | [1]2 | .... | 2.6 | .... | .... | 1.8 | .... | .... | .... |
| Rocky Mountain Natural Gas Co. Inc.—Collbran, Mesa Co., 35-9s-95w | 5.0 | 4.6 | 3 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| Piceance, Rio Blanco Co., 22-1n-97w | 15.0 | 1.2 | 3 | .... | .... | .... | .... | .... | 1.1 | .... | .... |
| Slick Rock, San Miguel Co., 30-44n-18w | 15.0 | 5.0 | 3 | .... | .... | .... | .... | .... | 1.4 | .... | .... |
| South Canyon, Garfield Co., 3-8s-104w | 15.0 | 7.0 | 3 | .... | .... | .... | .... | .... | 1.5 | .... | .... |
| Roggen Gas Processing Co.—Roggen, Main, Weld Co., se¼ sw¼ 24-2n-63w | 31.0 | 21.6 | 7 | .... | 45.3 | .... | .... | .... | 33.6 | .... | .... |
| Vallery, Morgan Co., 15-3n-59w | 1.5 | 0.8 | 3 | .... | .... | .... | .... | .... | 2.6 | .... | .... |
| Tejas Gas Corp.—Chalice, Arapahoe Co., 10-4s-64w | 3.0 | 1.4 | 3 | .... | .... | .... | .... | 3.5 | .... | .... | .... |
| Running Creek, Elbert Co., 21-6s-64w | 5.0 | 3.4 | 3-6 | .... | .... | .... | .... | 17.0 | .... | .... | .... |
| Texaco Inc.—Wilson Creek, Rio Blanco Co., 27-3n-94w | 2.0 | 1.2 | 3 | .... | .... | .... | .... | .... | 3.8 | .... | .... |
| Texas Oil & Gas Corp.—Baca County, 11-33s-42w Grid 9 | 5.0 | 2.2 | 3 | .... | .... | .... | .... | .... | 9.3 | .... | [11]0.1 |
| Union Pacific Resources—*Bledsoe Ranch, Cheyenne Co., 1-t13s-r51w | 3.0 | 0.7 | 3 | .... | .... | .... | .... | .... | 2.1 | .... | .... |
| *Mt. Pearl, Cheyenne Co., 35-t13s-r48w | 10.0 | 7.0 | 3 | .... | .... | .... | .... | .... | 14.0 | .... | .... |
| Vessels Gas Processing Ltd.—Ft. Lupton, Weld Co., se¼ 28-1n-67w | 45.0 | 30.0 | 3 | .... | .... | .... | .... | .... | 40.0 | .... | .... |
| Vessels Oil & Gas Co.—Ft. Lupton Fractionator, Weld Co., se½ 28-ln-67w | 40.0 | 24.4 | 3 | .... | (9.5) | .... | (8.0) | .... | .... | (9.7) | .... |
| Western Gas Processors Ltd.—Lanson Farms, Weld Co., nw4-ne4 35-2n-68w | 1.5 | 0.1 | 3 | .... | .... | .... | .... | .... | 1.5 | .... | .... |
| Williams Field Services Co.—Piceance Creek, Rio Blanco Co., 5&8, t-2-s, r-96-w | 30.0 | 1.0 | [31]5 | .... | .... | .... | .... | .... | 0.1 | .... | .... |
| **Total** | **1,101.5** | **687.8** | | **63.1** | **248.0** | .... | **98.9** | **44.4** | **655.8** | **57.6** | **18.3** |

†Butane-gasoline mix.

## FLORIDA

| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Enron Gas Processing Co.—Brooker, Bradford Co. | 800.0 | 725.0 | [19]2 | .... | 55.0 | 22.0 | 20.0 | .... | .... | 51.0 | .... |
| Exxon Co. USA—Jay, Santa Rosa Co., 9 n43-5n-29w | 90.0 | 30.0 | 6-7 | 71.1 | 60.8 | .... | 59.0 | .... | .... | 19.1 | .... |
| **Total** | **890.0** | **755.0** | | **71.1** | **115.8** | **22.0** | **79.0** | .... | .... | **70.1** | .... |

## KANSAS

| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Production Co.—Ulysses, Grant Co., 5-29s-38w | 400.0 | 118.0 | [19-49]2 | .... | .... | .... | .... | 46.3 | 85,0 | .... | .... |
| Anadarko Petroleum Corp.—Cimarron, Seward Co., 23-33s-32w | 15.0 | 13.0 | [1]2 | .... | 8.2 | .... | .... | .... | 9.0 | .... | .... |
| Woods, Seward, 22-33s-34w | 8.0 | 7.0 | [1]2 | .... | 2.4 | .... | .... | .... | 5.6 | .... | .... |
| Colorado Interstate Gas Co.—Lakin, Kearney Co., n2 ne4 29-24s-36w | 250.0 | 82.0 | 1 | .... | .... | .... | .... | .... | 18.2 | .... | .... |
| Morton Co.,ne4 ne4 18-33s-43w | 25.0 | 21.0 | 3 | .... | .... | .... | .... | .... | 36.7 | .... | .... |
| Enron Gas Processing Co.—Bushton ethane, Ellsworth Co., 31-17s-9w | 500.0 | 364.0 | 7 | 358.0 | .... | .... | .... | .... | .... | .... | .... |
| Bushton hydrocarbon, Ellsworth Co., 31-17s-9w | 950.0 | 962.0 | [19]2 | .... | 677.1 | 95.5 | 213.9 | .... | .... | 166.4 | .... |
| Enron Helium Co.—Bushton, Ellsworth Co., 31-17s-19w | 500.0 | 511.0 | 6 | .... | .... | .... | .... | .... | .... | .... | †1.8 |
| KN Energy Inc.—Scott City Helium, Scott Co., 17-18s-33w | 75.0 | 62.0 | 3 | 2.2 | 33.8 | .... | 18.5 | .... | .... | 4.3 | .... |
| Scott City NGL, Scott Co., 17-18s-33w | 150.0 | 99.8 | 1 | .... | .... | .... | 2.0 | .... | .... | 12.8 | .... |
| Sunflower, Scott Co., 17-18s-33w | 168.0 | 66.3 | 3-6 | .... | .... | .... | .... | .... | 85.0 | .... | .... |
| Mesa Limited Partnership—Ulysses, Grant Co., 10-30s-37w | 242.0 | 80.7 | [19]2 | .... | .... | .... | .... | .... | 86.6 | .... | .... |
| Mobil Oil Corp.—Hickok, Grant Co., 31-28s-35w | 210.0 | 102.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| National Helium Corp.—Seward Co., 23-33s-32w | 800.0 | 642.0 | 3 | .... | 204.7 | .... | 174.1 | .... | .... | 108.2 | .... |
| Northern Natural Gas Co.—Holcomb, Finney Co., 3-24s-34w | 200.0 | 181.4 | 3 | .... | .... | .... | .... | .... | 42.1 | .... | .... |
| Oxy U.S.A. Inc.—Cheney, Kingman Co., nw4 22-t28s-r5w | 85.0 | 29.8 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hutchinson, Reno Co., sw4 22-23s-6w | .... | .... | † | (187.0) | (683.0) | (112.0) | (270.0) | .... | .... | (251.0) | .... |
| Jayhawk, Grant Co., 2-t29s-r35w | 550.0 | 285.0 | 6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Kansas Gas Supply/Glick, Kiowa Co., 20-t30s-r15w | 100.0 | 50.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Midway, Kingman Co., 33-t27s-r5w | 30.0 | 23.0 | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Spivey, Harper Co., 5-t31s-r8w | 66.0 | 21.0 | 2 | .... | .... | .... | .... | .... | .... | 11.0 | .... |
| Wichita, Sedgwick Co., 17-t28s-r1e | 89.6 | 53.3 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Wilburton, Morton Co., 33-t34s-r41w | 5.0 | 2.0 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Peoples Natural Gas Co.—Burrton, Harvey Co., 21-23s-34w | 4.5 | 1.7 | 3 | .... | .... | .... | .... | 0.9 | .... | .... | .... |
| Texaco Producing Inc.—Minneola, Ford Co., 13-29s-25w | 25.0 | 8.1 | [19]2 | .... | 10.8 | .... | .... | .... | 10.0 | .... | [11]<0.1 |
| **Total** | **5,448.1** | **3,786.1** |  | **380.2** | **937.0** | **95.5** | **408.5** | **47.2** | **378.2** | **302.7** | **1.9** |

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†Fractionation. (Figures in parenthesis do not represent primary production, and are not added in state totals). ‡Helium—MMcfd.

## KENTUCKY

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Kentucky Hydrocarbon—Dwale Cryogenic, Floyd Co. | 20.0 | 12.0 | 3-7 | .... | .... | .... | .... | .... | 24.0 | .... | .... |
| Maytown, Floyd Co. | 51.0 | 33.6 | 3-6-7 | .... | .... | .... | .... | .... | 93.5 | .... | .... |
| **Total** | **71.0** | **45.6** |  | .... | .... | .... | .... | .... | **117.5** | .... | .... |

## LOUISIANA

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Amoco Production Co.—West Hackberry Cameron Par., 19-12s-10w | 2.0 | 1.0 | 7 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| ARCO Oil & Gas Co.—*Bayou Sale, St. Mary Par., 17-II.S-9e | 97.0 | 22.6 | [19]2 | .... | 4.5 | .... | 2.5 | .... | .... | 3.0 | .... |
| Arkla Inc.—Elm Grove, Bossier Par. | 3.0 | 1.3 | 3 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| Gayles, Caddo Par., 30-16n-12w | 3.0 | 1.3 | 3 | .... | .... | .... | .... | .... | 0.3 | .... | .... |
| Associated Natural Gas Inc.—*Minden, Webster Par., s26-21n-910 | 55.0 | 38.5 | [19]2 | .... | 22.6 | 10.3 | 9.6 | .... | .... | 16.2 | .... |
| Bruin Petroleum Inc.—*Port Hudson, East Baton Rouge, Par. | 40.0 | 30.0 | 3 | .... | .... | .... | .... | .... | 21.0 | .... | .... |
| Chevron U.S.A.—Krotz Springs, St. Landry Parish | 100.0 | 3.5 | [19]1 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Judge Digby, W. Baton Rouge Parish | 250.0 | 45.0 | [7]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bergeron-Haydel, W. Baton Rouge Parish | 20.0 | 4.5 | [7]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Claiborne Gasoline Co.—*Lisbon, Claiborne Par., 20-21n-4w | 75.0 | 46.7 | [19]2 | .... | 27.0 | 12.7 | 16.3 | .... | .... | 29.7 | .... |
| Coastal Oil & Gas Corp.—Pelican, St. Mary Par., 51&52 15s-11e | 250.0 | 220.0 | 7 | .... | .... | .... | .... | .... | 169.3 | .... | .... |
| Conoco Inc.—Acadia Par., 31-9s-1w | 65.0 | 28.0 | 7 | 17.6 | 10.2 | .... | 7.2 | .... | .... | 36.9 | [3]0.9<br>[9]0.4 |
| Gillis, Calcasieu Par., se¼ sw¼ 14-9s-8w | 180.0 | 171.6 | 7 | 158.7 | 107.2 | 39.2 | 27.6 | .... | .... | 39.3 | [11]2.6 |
| Grand Chenier, Cameron Par., 2-39-40 15s-6w | 950.0 | 325.0 | [19]2-7 | .... | .... | .... | .... | .... | 356.1 | .... | .... |
| CSX NGL Corp.—Cow Island, Vermilion Par., 29-135-2e | 950.0 | 283.0 | [19]2 | .... | .... | .... | .... | .... | 251.7 | .... | .... |
| Eunice, Acadia Par., sw¼ nw¼-12-75-2w | 1,350.0 | 992.0 | [19]2-7 | 254.4 | 202.0 | 69.3 | 57.6 | .... | .... | 136.0 | .... |
| Riverside fractionation, Ascension Par., 8-10s-2e 46-9s-2e | .... | .... | † | (193.8) | (146.1) | (50.4) | (49.3) | .... | .... | (85.9) | .... |
| Davis, J.L.—White Castle, Iberville Par., 15-10s-13e | 7.5 | .... | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Endevco Natural Gas Co.—Dubach, Lincoln Par. | 90.0 | 25.0 | 3 | .... | 45.0 | 12.7 | 15.5 | .... | .... | 37.8 | .... |
| Calhoun | 60.0 | 30.0 | [19]2 | .... | .... | .... | .... | 30.0 | .... | .... | .... |
| Exxon Co. USA—Baton Rouge, West Baton Rouge Co., | 225.0 | 173.0 | 6-7 | 101.3 | 49.8 | 16.3 | 14.4 | .... | .... | 28.9 | .... |
| Bluewater, Acadia Par., 34-10s-1w | 950.0 | 515.0 | 6-7 | 219.7 | 91.8 | 29.1 | 26.9 | .... | .... | 68.7 | .... |
| *Garden City, St. Mary's Par., 45-46-15s-10e | 600.0 | 197.0 | 2 | 102.0 | 72.1 | 22.9 | 16.9 | .... | .... | 42.8 | .... |
| Grand Isle, Jefferson Par., 32-21s-25e | 130.0 | 102.0 | 7 | .... | .... | .... | .... | .... | 167.0 | .... | [11]<0.1 |
| J.P. Oil Co.—Elba, St. Landry Par., 4s-7e | 1.5 | 0.8 | 3 | .... | .... | .... | .... | .... | 1.7 | .... | .... |
| Kerr-McGee Corp.—Bayou Crook Chene, St. Martinville Par., 34-10s-9e | 12.5 | NR | 2 | .... | .... | .... | .... | .... | 16.0 | .... | .... |
| Kinder Gas Processing Corp.—Kinder, Allen Par. 23-5s-5ww | 25.0 | 6.0 | [19]2 | .... | 4.0 | .... | 6.7 | .... | .... | 1.7 | .... |
| LIG Liquids Corp.— |  |  |  |  |  |  |  |  |  |  |  |
| Aymond, St. Mary Par., 13-14s-9e | 40.0 | 8.9 | 7 | .... | .... | .... | .... | .... | 9.3 | .... | .... |
| Gibson, Terrebonne Par., 77-16s-15e | 90.0 | 64.6 | 7 | .... | .... | .... | .... | .... | 80.6 | .... | .... |
| Plaquemine, Iberville Par., 46-10s-12e | 225.0 | 118.4 | 7 | .... | 49.5 | 16.4 | 16.9 | .... | .... | 37.5 | [5]104.5 |
| St. Landry, Evangeline Par., 35-2s-2e | 70.0 | 66.0 | 2 | .... | 25.2 | .... | 15.6 | .... | .... | 13.8 | .... |
| Marathon Oil Co.—Burns Point, St. Mary Par., 15-t17s-r9e | 200.0 | 109.0 | 7 | .... | .... | .... | .... | .... | 95.0 | .... | .... |
| Cotton Valley, Webster Par., 26-t21n-r10w | 65.0 | 87.3 | 7 | 74.0 | 26.0 | 10.0 | 8.5 | .... | .... | 17.0 | [11]18.0 |
| Phoenix Lake, Calcasieu Par., R13w T11s | 1.0 | 0.1 | 6 | .... | .... | .... | .... | <0.1 | .... | .... | .... |
| Theall Lex Unit, Vermillion Par., 36-2E-T11S | 4.0 | 0.9 | 6 | .... | .... | .... | .... | .... | .... | .... | [11]1.8 |
| Oryx Energy Co.—Beaver Dam Creek, St. Helena Co. | 2.0 | 0.5 | 6 | .... | .... | .... | .... | .... | 0.9 | .... | .... |
| Delhi, Richland Par.,15-t17n-r9e | 22.0 | 15.8 | 6 | .... | 2.7 | .... | 2.6 | .... | .... | 9.1 | .... |
| *Fordoche, Pointe Coupee Par., 41-t6s-r8e | 35.0 | 32.2 | 7 | .... | .... | .... | .... | .... | 44.6 | .... | .... |
| *Gillis-English Bayou, Calcasieu Par., 26-t8s-r5w | 20.0 | 7.1 | [19]2 | .... | .... | .... | .... | .... | 10.6 | .... | .... |
| Maurice, Lafayette Par., 31-t10s-r4e | 32.0 | 9.2 | [19]2 | .... | .... | .... | .... | .... | 9.5 | .... | .... |
| South Sarepta, Bossier Par., 21-t22n-r11w | 25.0 | 9.0 | [19]2 | .... | .... | .... | .... | .... | 13.0 | .... | .... |
| Oxy U.S.A. Inc.—Cameron, Cameron Par. Tract 22 & 23, 15s-13w | 310.0 | 270.0 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Gulf Coast fractionation—Chambers Co., Henry Griffin League A-12 | .... | .... | † | (1,135.0) | (861.0) | (187.0) | (383.0) | .... | .... | (386.0) | .... |
| Lake Charles Fractionation, Calcasieu Par., 19-10s-9w | .... | .... | † | (400.0) | (318.0) | (100.0) | (85.0) | .... | .... | (153.0) | .... |
| Lowry, Cameron Par., 16-12s-4w | 300.0 | 130.0 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sea Robin II, Vermillion Par., 21-13s-4e | 200.0 | 105.0 | 7 | .... | .... | .... | .... | .... | 93.0 | .... | .... |
| Phillips, Jack L.—Oretta, Beauregard, Par. | 2.0 | 0.5 | 3 | .... | .... | .... | .... | .... | 0.8 | .... | .... |
| Placid Oil Co.—Patterson II, St. Mary Par., 48-15s-11e | 400.0 | 140.0 | 7 | .... | .... | .... | .... | .... | 111.0 | .... | .... |

| Company, plant, location | MMcfd |  | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas through-put |  | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Resources Extraction & Processing Co.—Bayou Vista 1, St. Mary Par., 11-155-11e | 200.0 | 200.0 | 7 | .... | .... | .... | .... | .... | 200.0 | .... | .... |
| Shell Western E&P Inc.—Barracuda, Cameron Par., 24-15s-13w | 195.0 | 144.2 | 7 | .... | .... | .... | .... | .... | 191.7 | .... | .... |
| Calumet, St. Mary Par., 11, 12, 51, 52,-15s-11e | 1,200.0 | 911.6 | 2 | .... | .... | .... | .... | .... | 462.0 | .... | .... |
| Crawfish, St. Charles Par., 36-13s-8e | 120.0 | 34.0 | 7 | .... | .... | .... | .... | .... | 31.6 | .... | .... |
| Norco fractionator, St. Charles Par., 6-12s-8e | .... | .... | † | (565.2) | (319.2) | (109.5) | (116.9) | .... | .... | (227.2) | .... |
| North Terrebonne, Terrebonne Par., 19,20,29,33-17s-15e | 1,250.0 | 864.4 | 2 | .... | .... | .... | .... | .... | 817.0 | .... | .... |
| Stingray, Cameron Par., 33&34-15s-13w | 295.0 | 190.9 | 2 | .... | .... | .... | .... | .... | 91.7 | .... | .... |
| Tebone fractionator, Ascension Par., 45&46-9s-2e | .... | .... | † | (203.1) | (275.6) | (80.5) | (78.0) | .... | (179.8) | .... | .... |
| Toca, St. Bernard Par., 54-14s-14e | 830.0 | 483.6 | 2-7 | .... | .... | .... | .... | .... | 523.0 | .... | .... |
| Yscloskey, St. Bernard Par., 39-13s-15e | 1,850.0 | 1,624.8 | 2 | .... | .... | .... | .... | .... | 1,078.6 | .... | .... |
| Sid Richardson Carbon & Gasoline Co.—Hico-Knowles, Lincoln Par., 9 acres sw¼ of se¼10 & nw¼ of ne¼ 15-20n-3w | 15.0 | 3.1 | 7 | .... | .... | .... | .... | .... | 5.1 | .... | [11]0.2 |
| Tejas Gas Corp., Lake LaRose, St. Martin Parish | 16.0 | 4.3 | 7 | .... | .... | .... | .... | 5.4 | .... | .... | .... |
| Tenneco Natural Gas Liquids Corp.—R.M. Stephens, Claiborne Par., 6&7-13s-12e | 35.0 | 18.9 | 2 | .... | 15.5 | .... | 11.0 | .... | .... | 8.4 | .... |
| Sabine Pass, Cameron Par. | 200.0 | 138.1 | 7 | .... | .... | .... | .... | .... | 108.4 | .... | .... |
| Texaco Inc.—Alligator Bayou, St. Martin Par. sw14 34-10s-9e | 27.0 | 13.7 | 6-7 | .... | .... | .... | .... | .... | 23.2 | .... | [11]0.8 |
| Floodway, St. Mary Par., 16-16s-12e | 600.0 | 155.6 | 6-7 | .... | .... | .... | .... | .... | 133.5 | .... | .... |
| Henry, Vermilion Par., 21-13s-4e | 803.0 | 455.7 | [37]2-6-7 | 150.4 | 83.7 | 28.8 | 25.0 | .... | .... | 62.4 | .... |
| Paradis, St. Charles Par., 39-14s-20e | 660.0 | 168.5 | [43]2<br>6-7 | 74.5 | 84.4 | 18.1 | 17.5 | .... | .... | 32.0 | .... |
| Sea Robin, Vermilion Par., 21-13s-4e | 900.0 | 119.7 | 6-7 | .... | .... | .... | .... | .... | 125.2 | .... | .... |
| Venice, Plaquemines Par., 25&26 21s-30e | 65.0 | 21.7 | [46]2 | .... | .... | .... | .... | .... | 14.8 | .... | .... |
| Texas Eastern Transmission Corp.—Iowa, Jefferson Davis Par., 18-9s-6w | 500.0 | 370.0 | 6-7 | .... | .... | .... | .... | .... | 206.0 | .... | .... |
| Pointe au Chien, Terrebonne Par., 18-19s-20e | 125.0 | 71.0 | 7 | .... | .... | .... | .... | .... | 49.0 | .... | .... |
| Texas Oil & Gas Corp.—Ruston, Lincoln Par., ne4 of nw4 12-19n-4n | 30.0 | .... | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Union Texas Petroleum—Cox Bay, Plaquemine Par., 5-18s-16e | 20.0 | 13.4 | [19]1 | .... | 3.0 | 1.0 | 1.1 | .... | .... | 2.8 | .... |
| Pointe-a-la-Hache, Plaquemine Par., 78-13s-14e | 20.0 | 9.5 | [19]2 | .... | 1.1 | 0.5 | 0.4 | .... | .... | 1.5 | .... |
| Sligo, Bossier Par., 29-18n-11w | 70.0 | 25.7 | [19]2 | .... | 10.1 | 2.3 | 3.2 | .... | .... | 6.5 | .... |
| Toca, St. Bernard Par., 56-14s-14e | 160.0 | 97.3 | [19]2 | .... | 40.6 | 12.2 | 13.7 | .... | .... | 30.1 | .... |
| Warren Petroleum Co.—Johnson Bayou, Cameron Par., 10 acres 32&33 t15s-r13w | NR | 3.4 | 7 | .... | .... | .... | .... | .... | 3.0 | .... | .... |
| Krotz Springs, St. Landry Par., 22-6s-6e | NR | 4.0 | [19]2 | .... | 3.3 | .... | 2.4 | .... | .... | 6.2 | [11]8.1 |
| Mermentau, Acadia Par., n½-n½ 70-t10s-r2w | NR | 22.6 | 1 | .... | .... | .... | .... | .... | 22.0 | .... | .... |
| Venice, Plaquemines Par., 25-21s-30e | NR | 446.7 | [19]2 | .... | 113.2 | 42.7 | 41.9 | .... | 66.5 | .... | [5]182.7 |
| Vermilion Par., s2 sw4 nw4 28-13s-2e | NR | 56.1 | 7 | .... | .... | .... | .... | .... | 80.8 | .... | .... |
| **Total** | **18,720.5** | **11,059.8** |  | **1,152.6** | **1,094.5** | **344.5** | **361.0** | **35.5** | **5,698.3** | **668.3** | **320.1** |

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†Fractionation. (Figures in parenthesis do not represent primary production, and are not added in state totals).

## MICHIGAN

| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Production Co.—Kalkaska Co., 31-27n-7w | 180.0 | 88.0 | 7 | .... | .... | .... | .... | 42.4 | 65.7 | .... | [11]18.0 |
| ANR Pipeline Co.—*Austin dehydration, Mecosta Co., 4-14n-9w | 500.0 | 125.0 | [32]5 | .... | .... | .... | .... | .... | .... | .... | [11]1.7 |
| *Capac dehyd., St. Clair, 16-7n-13e | 300.0 | 105.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *C. Charlton-1 sep., Otsego Co., 1-30n-1w | 270.0 | 130.0 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]6.9 |
| *Coldwater dehyd., Isabella Co., 29-16n-6w | 40.0 | 16.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Croton dehyd., Newaygo Co., 29-12n-11w | 50.0 | 16.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Goodwell dehyd., Newaygo Co., 4-14n-11w | 385.0 | 148.0 | [32]5 | .... | .... | .... | .... | .... | .... | .... | [11]1.8 |
| *Lincoln dehyd., St. Clair Co., 20-18n-5w | 300.0 | 132.0 | [32]5 | .... | .... | .... | .... | .... | .... | .... | [11]1.2 |
| *Loreed, Osceola Co., 30-18n-10w | 32.0 | 29.0 | 3 | .... | .... | .... | .... | .... | 1.6 | .... | .... |
| *Loreed dehyd., Osceola Co., 30-18n-10w | 1,000.0 | 237.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Muttonville dehyd., Macomb Co., 13-4n-14e | 450.0 | 153.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *North Hamilton dehyd., Clare Co., 6-19n-3w | 40.0 | 11.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Norwich dehyd., Newaygo Co., 4-14n-11w | 50.0 | 22.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Orient dehyd., Osceola Co., 13-17n-7w | 50.0 | 22.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Reed City dehyd., Osceola Co., 30-18n-10w | 300.0 | 86.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *South Chester-15 sep., Otsego Co., 15-29n-2w | 270.0 | 130.0 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]6.9 |
| *Winfield dehyd., Montcalm Co., 7-12n-9w | 100.0 | 43.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Conoco Inc.—Aurelius, Ingham Co., 36-2n-2w | 22.0 | 4.5 | [19]2 | .... | 7.2 | .... | .... | 7.9 | .... | .... | .... |
| Marathon Oil Co.—Scipio, Hillside Co., 10-5s-3w | 38.0 | 4.5 | [19]2 | .... | 17.4 | .... | .... | .... | .... | 15.0 | .... |
| Stoney Point, Hillsdale Co., 5-5s-2w | 4.0 | 3.9 | 3 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| West Branch, Ogemaw Co., 27-22n-2e | 20.0 | 12.7 | 7 | .... | .... | .... | .... | .... | 24.2 | .... | .... |
| Michigan Consolidated Gas Co.—Romeo, Macomb Co., 14-4n-12e | 15.0 | 10.0 | 3 | .... | .... | .... | .... | .... | 7.7 | .... | [11]1.9 |
| Oryx Energy Co.—Akron, Tuscola Co. | 10.0 | 1.3 | 3 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| *Columbus Iii, Saint Clair Co., 3-t5n-r15e | 7.4 | 6.5 | 3 | .... | .... | .... | .... | .... | 8.0 | .... | .... |
| Kawkawlin, Bay Co. | 1.5 | 1.4 | 3 | .... | .... | .... | .... | .... | 0.7 | .... | .... |
| Mentor, Oscoda Co., 29-t25n-r3e | 9.7 | 10.5 | ... | .... | .... | .... | .... | .... | 5.2 | .... | .... |
| Mt. Pleasant, Isabella Co., 2-t14n-r3w | 3.0 | 0.7 | 3 | .... | .... | .... | .... | .... | 0.9 | .... | .... |
| Norwich, Missaukee Co., 12-t24n-r5w | 10.0 | 2.1 | 6 | .... | .... | .... | .... | .... | 8.1 | .... | .... |
| Williams, Midland Co., 35-15n-2e | 1.5 | 0.2 | 3 | .... | .... | .... | .... | .... | 0.7 | .... | .... |
| Shell Western E&P Inc.—Foster 28, Ogemaw Co., 28-24n-2e | 15.0 | 5.6 | 6 | .... | .... | .... | .... | 11.3 | .... | .... | .... |
| Kalkaska Co., 32-27n-7w | 350.0 | 147.0 | 2 | .... | .... | .... | .... | .... | 537.7 | .... | .... |
| **Total** | **4,824.1** | **1,703.9** |  | .... | **24.6** | .... | .... | **61.6** | **665.1** | **15.0** | **38.4** |

## MISSISSIPPI

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kerr-McGee Corp.—McComb, Amite Co., 21-4n-6e | 2.0 | NR | 3 | .... | .... | .... | .... | .... | 1.2 | .... | .... |
| Koch Hydrocarbon Co.—Harmony, Clarke Co., 26-2n-14e | 30.0 | 5.3 | 3 | .... | 6.9 | .... | 5.7 | .... | .... | 6.3 | [11]2.3 |
| Pronto Gas Co.— Laurel, Jones Co. | 1.2 | .7 | 3 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Shell Western E&P Inc.— | | | | | | | | | | | |
| Goodwater, Clarke Co., 5-10n-8w | 15.0 | 4.1 | 3 | .... | 1.5 | .... | 1.4 | .... | .... | 1.4 | .... |
| Tallahala Creek, Smith Co., 5-1n-9e | 4.0 | 4.2 | 3 | .... | 0.9 | .... | 0.9 | .... | .... | 1.4 | .... |
| Thomasville, Rankin Co., 27-4n-3e | 100.0 | 57.4 | [33]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Southern Natural Gas Co.—*Muldon, Monroe Co., 27-15s-6e | 750.0 | 302.0 | [8]5 | .... | .... | .... | .... | .... | 10.6 | .... | .... |
| **Total** | **902.2** | **373.7** | | .... | **9.3** | .... | **8.0** | .... | **15.8** | **9.1** | **2.3** |

## MONTANA

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Oil & Gas Corp.—Stateline, Richland Co., 7 22n-59e | 12.0 | 2.2 | 3 | .... | 5.1 | .... | .... | 5.4 | .... | .... | [11]0.8 |
| Shell Western E&P Inc.— | | | | | | | | | | | |
| Cabin Creek, Fallon Co., 18-10n-58e | 1.9 | 1.5 | 3 | .... | 2.0 | .... | 2.7 | .... | .... | 2.4 | .... |
| Little Beaver, Fallon Co., 8-4n-62e | 0.4 | 0.3 | 3 | .... | 0.9 | .... | 0.6 | .... | .... | 0.5 | .... |
| South Pine, Wibaux Co., 10-11n-57e | 1.2 | 0.7 | 3 | .... | 2.0 | .... | 1.7 | .... | .... | 1.6 | .... |
| True Oil Co.—Bob Rhodes, Richland Co., ne 4-25n-58e | 4.0 | 0.5 | 3 | .... | .... | .... | .... | .... | 3.1 | .... | .... |
| Western Gas Processors Ltd.—Baker, Fallon Co., sw4 sw4 6-7n-60e | 2.5 | 1.8 | 3 | .... | 12.6 | 6.8 | .... | 3.5 | 15.1 | 6.6 | .... |
| Fairview, Richland Co., w2 sw4 24-25n-58e | 5.0 | 3.6 | 3 | .... | 7.0 | .... | .... | 8.8 | .... | .... | [11]0.2 |
| **Total** | **27.0** | **10.6** | | .... | **29.6** | **6.8** | **5.0** | **17.7** | **18.2** | **11.1** | **1.0** |

## NEBRASKA

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oxy U.S.A. Inc.—Kimball, Kimball Co., 10-12n-55w | **1.5** | **0.9** | **3-4** | .... | .... | .... | .... | .... | .... | .... | .... |

## NEW MEXICO

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Production Co.—*Empire Abo, Eddy Co., 3-18s-27e | 42.0 | 40.0 | 7 | .... | .... | .... | 9.2 | 34.3 | 87.9 | <0.1 | .... |
| Gallegos Canyon, San Juan Co.,33-275-13w | 5.0 | 2.0 | 3 | .... | .... | .... | .... | .... | 4.2 | .... | .... |
| Bannon Energy Corp.—South Blanco Creek, 6-7w-23n | 6.0 | 2.4 | 3 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Cabot Transmission Corp.—Hobbs, Lea Co. Sec. 28, 18s-36e | 60.5 | .... | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Conoco Inc.—Maljamar, Lea Co., sw se 21-17s-32e | 40.0 | 30.0 | 7 | .... | .... | .... | .... | .... | 179.3 | .... | [11]4.5 |
| San Juan Co., 14-29n-11w | 500.0 | 505.0 | 7 | .... | .... | .... | .... | .... | 1,484.2 | .... | .... |
| Davis, J.L.—Denton, Lea Co., 2-7-155-37e | 15.0 | 6.0 | 7 | .... | .... | .... | .... | .... | 42.0 | .... | .... |
| El Paso Natural Gas Co.—Blanco, San Juan Co., n2-n2 14-t29n-r11w | 558.0 | 467.6 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Chaco, San Juan Co., sw4 16-t26n-r12w | 594.0 | 370.0 | [18]2 | .... | .... | .... | .... | .... | 384.3 | .... | .... |
| Jal No. 3, Lea Co., nw4-sw4 33-t-24s,r-37e | 225.0 | 25.0 | [19]2 | .... | .... | .... | .... | .... | 56.3 | .... | .... |
| San Juan River, San Juan Co., Sec. 1, t29n-r15w | 50.0 | 20.0 | [7-20]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Wingate, McKinley Co., 16&17-t15n-r17w | .... | .... | † | .... | (353.8) | (87.8) | (161.6) | .... | ... | (202.6) | .... |
| Marathon Oil Co.—Indian Basin, Eddy Co., s23-t21s-r23e | 180.0 | 102.5 | 7 | .... | .... | .... | .... | .... | 159.6 | .... | [11]27.5 |
| Minerals Inc.—Hobbs, Lea Co., sw¼-sw¼-ne¼ 36-18s-36e | 45.0 | 25.0 | 7 | .... | .... | .... | .... | .... | 40.0 | .... | .... |
| Northern Natural Gas Co.—Hobbs, Lea Co., 6-19s-37e | 220.0 | 85.9 | [19]2 | .... | .... | .... | .... | .... | 131.2 | .... | .... |
| Oxy U.S.A. Inc.—Bluitt, Roosevelt Co., 15-6s-36e | 27.5 | 14.5 | 7 | .... | .... | .... | .... | .... | 78.8 | .... | .... |
| Phillips 66 Natural Gas Co.—Artesia, Eddy Co., s2 se4 7-18s-28e | 53.0 | 45.0 | 7 | .... | .... | .... | .... | .... | 199.0 | .... | .... |
| Eunice, Lea Co., ne4 3-22s-37e | 80.0 | 84.0 | 7 | .... | .... | .... | .... | .... | 397.1 | .... | .... |
| Lee, Lea Co., sw4 se4 30 nw4-ne4-31-17s-35e | 35.0 | 36.0 | 7 | .... | .... | .... | .... | .... | 322.2 | .... | .... |
| Sunterra Gas Processing Co.— | | | | | | | | | | | |
| Kutz No. 1, San Juan Co., nw4 13-28n-11w | 140.0 | 42.4 | 2 | .... | .... | .... | .... | .... | 89.6 | .... | .... |
| Kutz No. 2, San Juan Co., nw4 13-28n-11w | 85.0 | 70.0 | 7 | .... | .... | .... | .... | .... | 206.3 | .... | .... |
| Lybrook, Rio Arriba Co., nw¼ 14-23n-7w | 85.0 | 40.5 | 7 | .... | .... | .... | .... | .... | 74.8 | .... | .... |
| Texaco Inc.—Buckeye, Lea Co., se¼ of se¼ 36-17s&18s-34e, l mi se of Buckeye | 25.0 | 4.5 | 6 | .... | .... | .... | .... | .... | 51.6 | .... | [11]0.3 |
| Texaco Producing Inc.—Eunice No. 1, Lea Co., 27-22s-37e | 105.0 | 69.3 | 7 | 160.4 | 102.9 | 11.5 | 32.7 | .... | .... | 43.9 | [11]3.1 |
| Warren Petroleum Co.— | | | | | | | | | | | |
| Eunice, Lea Co., ne4 3-22s-37e | NR | 48.0 | 7 | .... | .... | .... | .... | .... | 238.5 | .... | .... |
| Monument, Lea Co., sw4 36-19s-36e | NR | 44.8 | 7 | .... | 27.8 | .... | .... | .... | 162.0 | .... | .... |
| Saunders, Lea Co., 34-14s-33e | NR | 20.6 | 6 | .... | .... | .... | .... | .... | 167.0 | .... | .... |
| Vada, Lea Co., sw2-sw4-nw4 23-10s-33e | NR | 9.4 | 6 | .... | .... | .... | .... | .... | 69.0 | .... | .... |
| **Total** | **3,176.0** | **2,210.4** | | **160.4** | **130.6** | **11.5** | **41.9** | **34.3** | **4,633.9** | **44.0** | **35.3** |

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†Fractionation. (Figures in parenthesis do not represent primary production, and are not added in state totals).

## NORTH DAKOTA

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cenex—Coyote Creek, Bowman Co., 131n-104w-27 | 3.0 | 0.6 | [19]2 | .... | 1.6 | .... | 2.0 | .... | .... | .... | .... |
| Koch Hydrocarbon Co.—Grasslands, McKenzie Co., 36-148n-105w | 70.0 | 50.5 | 7 | .... | 87.9 | .... | 61.4 | .... | 58.1 | .... | .... |

| Company, plant, location | MMcfd Gas capacity | MMcfd Gas throughput | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months) Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oxy U.S.A. Inc.—Lignite, Burke Co. nw4 7-t162n-r91w | 11.0 | 6.3 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| True Oil Co.—Red Wing Creek, McKenzie Co., ne27-148n-101w | 9.0 | 2.3 | 3 | .... | .... | .... | .... | .... | 11.5 | 2.9 | .... |
| Warren Petroleum Co.—Little Knife, Dunn Co., 16-141n-98w | NR | 16.9 | 7 | .... | 37.8 | .... | .... | .... | 37.9 | .... | .... |
| Western Gas Processors Ltd.—Alexander, McKenzie Co., e½ sw¼ sw¼ 18-152n-101w | 3.0 | 2.5 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]1.8 |
| Teddy Roosevelt, Billings Co., nw4-ne4 16-142n-99w | 65.0 | 27.8 | 2-7 | .... | 23.1 | .... | 20.7 | .... | .... | 20.7 | [11]11.1 |
| Temple, Williams Co., Lot 4, 30-159n-95w | 4.0 | 2.0 | 3 | .... | .... | .... | .... | .... | 5.9 | .... | [11]0.3 |
| Total | 165.0 | 108.9 | | .... | 150.4 | .... | 84.1 | .... | 113.4 | 23.6 | 13.2 |

## OKLAHOMA

| Company, plant, location | MMcfd Gas capacity | MMcfd Gas throughput | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months) Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| American Central Gas Cos. Inc.— | | | | | | | | | | | |
| Stroud, Lincoln Co., se4, 6-14n-6e | 12.0 | 7.0 | 3 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Amoco Production Co.— | | | | | | | | | | | |
| Hitchcock-Okeene, Blaine Co., 13-17n-11w | 55.0 | 26.0 | 7 | .... | .... | .... | .... | .... | 59.3 | .... | [11]1.9 |
| Mooreland, Woodward Co., 30-23n-18w | 145.0 | 72.0 | 7 | .... | .... | .... | .... | .... | 151.2 | .... | [11]5.6 |
| Anadarko Petroleum Corp.— | | | | | | | | | | | |
| Beaver Co., se 25-6n-21ecm | 8.0 | 5.8 | 7 | .... | .... | .... | .... | .... | 6.7 | .... | .... |
| North Richland Center, Texas Co., 33-6n-12ecm | 25.0 | 12.4 | [1]2 | .... | 13.7 | .... | .... | .... | 12.2 | .... | .... |
| ARCO Oil & Gas Co.— | | | | | | | | | | | |
| Covington, Garfield Co., w2-sw4 19-22n-3w | 15.0 | 11.5 | 7 | 9.6 | 14.0 | 2.3 | 6.4 | .... | .... | 8.0 | [11]0.8 |
| Drumright, Creek Co., nw4 sw4 28-18n-7e | 15.0 | 3.5 | [19]1 | 1.0 | 8.3 | 1.4 | 4.3 | .... | .... | 7.4 | [11]0.2 |
| Tecumseh, Pottawatomi Co., sw¼ 36-9n-3e | 5.0 | 8.7 | 3 | 7.9 | 14.1 | 2.0 | 6.7 | .... | .... | 5.9 | [11]3.1 |
| Associated Natural Gas Inc.— | | | | | | | | | | | |
| Custer, Custer Co. | 10.0 | 4.2 | 6 | 3.4 | 4.8 | 1.1 | 1.8 | .... | .... | 2.1 | .... |
| Milfay, Creek Co., nw/4 ne/4 21-t5n-r7e | 15.0 | 6.7 | 3 | 0.5 | 6.4 | 1.3 | 4.0 | .... | .... | 4.4 | .... |
| Oakwood, Custer Co. | 10.0 | 4.7 | 7 | 9.6 | 7.0 | 1.2 | 2.1 | .... | .... | 2.1 | .... |
| Silver City, Creek Co., n2 ne/4 nw/4 6-t15n-r8e | 5.0 | 1.4 | 3 | <0.1 | <0.1 | <0.1 | <0.1 | .... | .... | <0.1 | .... |
| Beard Oil Co.—Choctaw, Oklahoma Co., 23-12n-1w | 3.0 | 3.0 | 3 | .... | .... | .... | .... | 1.0 | .... | .... | .... |
| Cabot Transmission Corp.—Beaver Co., 25-5n-23ecm | 20.0 | 13.2 | 7 | .... | .... | .... | .... | .... | 32.6 | .... | .... |
| CNG Producing Co.—Southwest Davis, Murray Co.,15-15s-1e | 2.0 | 0.7 | 4 | .... | .... | .... | .... | .... | 2.8 | .... | .... |
| Coastal Oil & Gas Corp.—Custer Co., ne4 5-13n-17w | 200.0 | 137.9 | 7 | .... | .... | .... | .... | .... | 181.7 | .... | .... |
| Colorado Interstate Gas Co.—Sturgis, Cimarron, cn/2, 3-4n-8e | 30.0 | 23.3 | .... | .... | .... | .... | .... | 10.6 | .... | .... | |
| Conoco Inc.— | | | | | | | | | | | |
| Cashion, Kingfisher Co., ne ne 9-15n-5w | 30.0 | 20.0 | 7 | .... | .... | .... | .... | .... | 66.3 | .... | [11]0.7 |
| Clinton, Custer Co., sw 26-12n-16w | 75.0 | 60.0 | 7 | .... | .... | .... | .... | .... | 182.8 | .... | [11]0.2 |
| Hennessey, Kingfisher Co., nw nw 36-19n-7w | 30.0 | 26.0 | 7 | 45.2 | .... | .... | .... | 63.5 | .... | .... | [11]0.5 |
| Mustang, Grady Co., 30-10n-5w | 30.0 | 38.0 | 7 | .... | .... | .... | .... | .... | 78.3 | .... | [11]2.8 |
| Damson Gas Processing Corp.— | | | | | | | | | | | |
| Hooker, Texas Co., 8-4n-17e | 70.0 | 35.6 | 7 | .... | .... | .... | .... | .... | 106.[illegible] | .... | .... |
| Deisenroth Gas Products Inc.—Okemah, Okfuskee Co., 23-11n-9e | 1.0 | 1.0 | 1 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| El Paso Natural Gas Co.— | | | | | | | | | | | |
| *Beaver Co., se4-ne4 18-t3n-r26e | 40.0 | 0.1 | 3 | .... | .... | .... | .... | .... | 132.5 | .... | .... |
| Enogex Production Corp.— | | | | | | | | | | | |
| Calumet, Canadian Co., ne4 28-14n-9w | 250.0 | 140.0 | 2 | 10.0 | 1.5 | 5.6 | 8.9 | .... | .... | 1.1 | .... |
| Choctaw, Oklahoma Co.,sec 18-11n-1e | 6.0 | NR | 7 | 2.2 | 5.1 | 0.7 | 2.5 | .... | .... | 2.3 | .... |
| Dibble, McClain Co., 35-7n-4w | 2.0 | 1.5 | 3 | 1.2 | 1.8 | 0.3 | 0.9 | .... | .... | 1.1 | .... |
| Edmond, Okla. Co., 32-14n-4w | 15.0 | 13.0 | 7 | 11.9 | 14.0 | 2.0 | 5.6 | .... | .... | 4.6 | .... |
| Henryetta, Okmulgee Co., 33-13n-12e | 10.0 | 7.0 | 6 | 1.5 | 2.8 | 0.6 | 1.3 | .... | .... | 1.5 | .... |
| Slaughterville, Cleveland Co.,sec 11-7n-1e | 7.5 | NR | 3 | 0.5 | 1.1 | 0.2 | 0.5 | .... | .... | 0.4 | .... |
| Wellston, Lincoln Co., 3-13n-2e | 8.0 | 4.5 | 6 | 2.1 | 0.3 | 0.4 | 1.2 | .... | .... | 1.4 | .... |
| Enserch Processing Partners Ltd.— | | | | | | | | | | | |
| Wallville, Garvin Co., 27-4n-3w | 6.0 | 4.7 | [2]2 | .... | .... | .... | .... | .... | 5.3 | .... | .... |
| Exxon Co. USA—Camargo, Dewey Co., 10-18n-19w | 15.0 | 4.0 | [19]2 | 5.2 | .... | .... | .... | .... | 4.9 | .... | .... |
| Dover-Hennessey, Kingfisher Co., 1-18n-7w | 80.0 | 40.0 | 6 | 92.6 | 61.0 | 9.1 | 23.4 | .... | .... | 17.8 | .... |
| Kerr-McGee Corp.— | | | | | | | | | | | |
| Marlow, Stephens Co., 18-2n-7w | 2.0 | NR | 3 | .... | .... | .... | .... | .... | 1.4 | .... | .... |
| Milfay, Creek Co., 21-15n-7e | 12.0 | NR | 2 | .... | 4.4 | .... | .... | .... | 8.3 | .... | .... |
| Koch Hydrocarbon Co.—Fitts, Pontotoc Co., 30-[illegible]-7e | 5.0 | 1.1 | 3 | .... | 1.8 | .... | .... | .... | 4.7 | .... | .... |
| Lado Petroleum Corp.—Beaver Co., 30 t4n-r20ecm | 20.0 | 21.6 | 7 | .... | .... | .... | .... | .... | 44.4 | .... | .... |
| Maxus Exploration Co.—Red Fork, Roger Mills Co. sw¼r-21w-t15 | 30.0 | 27.3 | 7 | .... | .... | .... | .... | .... | 54.6 | .... | .... |
| McMoRan Oil & Gas Co.—Tyrone, Texas Co., sw¼ 19-6n-19 ecm | 36.0 | 20.4 | 7 | .... | .... | .... | .... | .... | 51.0 | .... | .... |
| Meridian Reserves Inc.— | | | | | | | | | | | |
| Enterprise, Payne Co., ne¼ 25-18n-5e | 5.0 | 0.9 | 3 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| HJD, Pawnee Co., nw¼ 7-20n-8e | 6.0 | 1.5 | 3 | .... | .... | .... | .... | .... | 2.0 | .... | .... |
| Lincoln Gas, Lincoln Co., se¼ 2-14n-5e | 5.0 | 0.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Meridian Energy, Lincoln Co., sw¼ 1-14n-5e | 10.0 | 2.1 | 3 | .... | .... | .... | .... | .... | 2.5 | .... | .... |
| Mid-America, Pawnee Co., e½ 30-20n-8e | 5.0 | 0.5 | 3 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| Patriot, Creek Co., w½ 7-17n-8e | 3.0 | 0.5 | 3 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| Poli Gas, Lincoln Co., e½ 23-14n-2e | 10.0 | 3.5 | 3 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| Mesa Limited Partnership— | | | | | | | | | | | |
| Binger, Caddo Co., 26-10n-11w | 15.0 | 5.7 | 7 | .... | .... | .... | .... | .... | 29.2 | .... | .... |
| Madill, Marshall Co., 32-7e-5s | 25.0 | 17.9 | [1]2 | .... | 22.7 | 2.2 | 7.3 | .... | .... | 7.2 | .... |
| Ringwood, Major Co., 11-22n-10w | 80.0 | 48.3 | [1]2-7 | .... | .... | .... | .... | .... | 148.5 | .... | .... |

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mobil Oil Corp.— | | | | | | | | | | | |
| Chitwood, Grady Co., 34-5n-6w | 90.0 | 64.0 | 7 | .... | .... | .... | .... | .... | 256.0 | .... | .... |
| NE Trail, Dewey Co., 1-17n-18w | 40.0 | 31.0 | [19]2 | .... | .... | .... | .... | .... | 46.9 | .... | .... |
| Postle Hough, Texas Co., 13-5n-13ecm | 20.0 | 15.0 | [19]2 | .... | .... | .... | .... | .... | 24.6 | .... | .... |
| *Putnam-Oswego, Dewey Co., 35-16n-16w | 50.0 | 35.0 | 7 | .... | .... | .... | .... | .... | 47.1 | .... | .... |
| *Seiling, Woodward Co., 32-20n-17w | 20.0 | 0.7 | 3 | (All products fractionated at NE Trail) | | | | | | | |
| Sholem Alechem, Stephens Co., 2-1s-4w | 60.0 | 36.0 | 7 | .... | .... | .... | .... | .... | 187.0 | .... | .... |
| Oklahoma Gas Pipeline Co.—Tyrone, Texas Co., sw¼ 11-6n-18e | 85.0 | 38.4 | 7 | .... | .... | .... | .... | .... | 55.8 | .... | .... |
| Oryx Energy Co.—Burlington, Alfalfa Co. 32-t28n-r11w | 3.0 | 0.6 | 3 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| Carney, Lincoln Co., 12-t15n-r2e | 15.0 | 10.7 | 7 | .... | .... | .... | .... | .... | 47.5 | .... | .... |
| Goldsby Central, McClain Co., 3-t17n-r3w | 65.0 | 41.3 | 7 | .... | .... | .... | .... | .... | 199.0 | .... | .... |
| Laverne, Harper Co., 20-t26n-r25w | 200.0 | 102.4 | 7 | .... | 61.0 | 14.0 | 29.7 | .... | .... | 36.7 | [5]175.3<br>[11]10.4 |
| Norge, Grady Co. | 5.0 | 4.5 | 3 | .... | .... | .... | .... | .... | 18.1 | .... | .... |
| Wakita, Grant Co., 5-t27n-r7w | 15.0 | 16.5 | [19]2 | .... | .... | .... | .... | .... | 49.4 | .... | [11]1.4 |
| Oxy NGL Inc.— | | | | | | | | | | | |
| Ambrose, Kay Co., sw4 9-t27n-r1w | 400.0 | 140.0 | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Garrett, Kay Co., ne4-ne4 34-t27n-r1e | 8.0 | 5.6 | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Murdock, Texas Co., 32-t5n-r16ecm | 40.0 | 7.2 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Rodman, Garfield Co., 27-t20n-r8w | 50.0 | 33.0 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Phillips 66 Natural Gas Co.—Aline, Cimarron, Woodward Co., e2 ne4 27-20n-17w | 66.0 | 63.2 | 7 | .... | .... | .... | .... | .... | 165.3 | .... | .... |
| Creek, Tulsa Co., s2 sw4 nw4 7-17n-13e | 25.0 | 21.5 | 7 | .... | .... | .... | .... | .... | 48.3 | .... | .... |
| Fox, Carter, Co., 28-2s-3w | 50.0 | 34.4 | 7 | .... | .... | .... | .... | .... | 134.7 | .... | .... |
| Kingfisher Co., nw4 sw4 9-15n-5w | 200.0 | 117.7 | 7 | .... | .... | .... | .... | .... | 365.4 | .... | .... |
| Lucien, Noble Co., 18-20n-2w | 22.0 | 11.6 | 3&7 | .... | .... | .... | .... | .... | 36.6 | .... | .... |
| Okarche, Kingfisher Co., se4 ne4 31-15n-8w | 165.0 | 114.7 | 7 | .... | .... | .... | .... | .... | 259.1 | .... | .... |
| Tejas Gas Corp.— | | | | | | | | | | | |
| Antioch, Garvin Co., 17-3n-2w | 10.0 | 5.9 | 3 | .... | .... | .... | .... | 16.0 | .... | .... | .... |
| Pauls Valley, Garvin Co., 12-3n-1w | 1.0 | 0.3 | 3 | .... | .... | .... | .... | 0.9 | .... | .... | .... |
| West Guthrie, Logan Co., 30-15n-2w | 15.0 | 11.0 | 7 | .... | .... | .... | .... | 40.0 | .... | .... | .... |
| Texaco Inc.—Enville, Love Co., 7-7s-3e | 15.0 | 7.2 | 7 | .... | .... | .... | .... | .... | 21.5 | .... | [11]1.5 |
| Maysville, Garvin Co., 18-4n-2w | 114.0 | 122.0 | 7 | 267.2 | 166.9 | 17.2 | 58.8 | .... | .... | 63.2 | .... |
| Texaco Producing Inc.— | | | | | | | | | | | |
| Camrick, Beaver Co., 31-1n-20 ecm | 14.0 | 7.4 | 7 | .... | .... | .... | .... | .... | 21.0 | .... | [11]2.1 |
| Kellyville, Creek Co., ne 27-17n-10e | 15.0 | 1.0 | 6 | .... | .... | .... | .... | .... | 4.8 | .... | [11]0.2 |
| Velma, Stephens Co., 23-ls-5w | 100.0 | 58.2 | 7 | .... | .... | .... | .... | .... | 232.4 | .... | [11]4.1 |
| Texas Oil & Gas Corp.— | | | | | | | | | | | |
| Antelope Hills, Roger Mills Co., 30-16n-24w | 50.0 | 30.1 | 7 | .... | .... | .... | .... | .... | 47.9 | .... | [11]0.3 |
| Beaver Co., 9-1n-27e | 50.0 | 49.0 | 7 | .... | .... | .... | .... | .... | 70.2 | .... | [11]0.4 |
| Cimarron, Blaine Co., nw4 24-18n-13w | 90.0 | .... | 7 | .... | .... | .... | .... | .... | .... | .... | [11]0.4 |
| Custer Co., sw4 nw4 34-14n-16w | 105.0 | 74.3 | 7 | .... | .... | .... | .... | .... | 125.1 | .... | [11]0.2 |
| El Reno, Canadian Co., nw4 sw4 33-14n-7w | 75.0 | 60.7 | 7 | .... | .... | .... | .... | .... | 107.4 | .... | [11]2.4 |
| Stephens, Stephens Co., 14-1s-r5w | 25.0 | .... | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Watonga, Kingfisher Co., w2 se4 35-15n-9w | 40.0 | .... | 7 | .... | .... | .... | .... | .... | .... | .... | [11]0.1 |
| Woodward Co., sw4 nw4 29-23n-21w | 75.0 | 33.7 | 7 | .... | .... | .... | .... | .... | 49.6 | .... | [11]0.9 |
| Tex/Con Oil & Gas Co.—Crescent, Logan Co., nw 34-17n-4w | 45.0 | 26.7 | 6 | 57.6 | 39.8 | 5.2 | 14.7 | .... | .... | 16.4 | [11]0.2 |
| *Elmore, Garvin Co., 17-1n-2w | 30.0 | 19.9 | 7 | 29.1 | 19[illegible] | 2.4 | 7.2 | .... | .... | 8.6 | [11]<0.1 |
| Redford, Roger Mills, Co. 32-15n-21w | 30.0 | 26.0 | 7 | 18.2 | 16.8 | 3.3 | 3.8 | .... | .... | 4.9 | .... |
| Union Pacific Resources—Enid, Garfield Co., 34-23n-6w | 35.0 | 16.0 | [21]2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Union Texas Petroleum Corp.— | | | | | | | | | | | |
| Chaney Dell, Major Co., 35-23n-10w | 130.0 | 84.1 | [19]2-7 | 97.6 | 78.9 | 12.2 | 29.1 | .... | .... | 50.3 | .... |
| Chester, Woodward Co., 2-20n-17w | 37.0 | 24.6 | 6-7 | 23.5 | 16.1 | 2.8 | 6.4 | .... | .... | 9.7 | .... |
| Lamont, Grant Co., 19-26n-3w | 30.0 | 27.5 | 7 | 62.2 | 49.5 | 6.0 | 17.3 | .... | .... | 19.5 | .... |
| Unocal—Caddo, Carter Co., 23-36-1e | 10.0 | 3.4 | 3 | .... | 4.1 | .... | .... | .... | 3.3 | .... | [11]0.2 |
| Valero Hydrocarbons Co.— | | | | | | | | | | | |
| Elk City, Beckham Co., 15-t10n-r21w | 85.0 | 7.1 | 7 | 12.8 | 24.3 | 4.8 | 9.3 | .... | .... | 10.3 | .... |
| Tecumseh, Pottawatomie Co., ne4 29-10n-3e | 14.0 | 11.3 | 3 | 9.5 | 14.9 | 2.0 | 6.5 | .... | .... | 6.1 | .... |
| Warren Petroleum Co.— | | | | | | | | | | | |
| Kingfisher Co., 11-15n-9w | NR | 7.2 | 7 | .... | .... | .... | .... | .... | 11.3 | .... | [11]0.4 |
| Knox, Grady Co., 33-3n-5w | NR | [illegible]4.6 | [19]2 | .... | 2.7 | .... | .... | .... | 9.9 | .... | [11]4.5 |
| Leedey, Roger Mills Co., 32-16n-21w | NR | 28.3 | 7 | .... | .... | .... | .... | .... | 101.5 | .... | .... |
| Mocane, Beaver Co., 18-5n-25e ecm | NR | 53.0 | [19]2 | .... | .... | .... | .... | .... | 123.7 | .... | .... |
| **Total** | **4,433.5** | **2,644.7** | | **702.2** | **679.3** | **100.4** | **259.8** | **188.4** | **4,[illegible]30.5** | **303.9** | **220.9** |

## PENNSYLVANIA

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tembec Co.—Waynesburg, Greene Co. | 14.0 | 8.3 | 3 | .... | 4.7 | .... | 3.0 | .... | .... | 4.1 | .... |
| Waynesburg, Greene Co. | .... | .... | † | .... | (1.6) | .... | (1.5) | .... | .... | (1.3) | .... |
| **Total** | **14.0** | **8.3** | | .... | **4.7** | .... | **3.0** | .... | .... | **4.1** | .... |

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†Fractionation. (Figures in parenthesis do not represent primary production, and are not added in state totals).

## TEXAS

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adobe Gas Gathering & Processing Co.—Apple Creek, Glasscock Co., 7-32-4s | 30.0 | 19.1 | 7 | .... | .... | .... | .... | .... | 149.1 | .... | .... |
| Adobe Resources Corp.—Sale Ranch, Martin Co., 23-37-1n | 16.0 | 10.2 | [19]2 | .... | .... | .... | .... | .... | 66.0 | .... | .... |
| Amax Oil & Gas Co.—Rocker B I, 17 miles ne of Big Lake | 16.0 | 5.0 | 7 | .... | .... | .... | .... | .... | 30.0 | .... | .... |
| American Central Gas Cos. Inc.—Foster, Ector Co., sw 18-42, TSST & PRR | 26.0 | 13.6 | 7 | 47.6 | 39.3 | .... | 21.7 | ..... | .... | 17.7 | .... |
| Live Oak | 20.0 | 18.5 | 7 | 10.1 | 8.7 | .... | 5.1 | .... | .... | 5.7 | .... |
| Amoco Production Co.— | | | | | | | | | | | |
| Anton-Irish, Hale Co., 14-DT HE&WT RR | 12.0 | 2.0 | 3 | .... | .... | .... | .... | .... | 13.5 | .... | .... |

| | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Cedar Lake, Gaines Co. | 3.0 | 1.0 | [4]3 | .... | .... | .... | .... | .... | 9.7 | .... | .... |
| Edgewood, Van Zandt Co., 2 Roberts A-702 | 60.0 | 28.0 | [19-40]2 | .... | .... | .... | .... | 10.0 | 22.0 | .... | [11]40.1 |
| Hastings, Brazoria Co., 1-ACH-DA-416 | 70.0 | 55.0 | 7 | .... | .... | .... | .... | .... | 18.7 | .... | .... |
| Mallett $CO_2$ removal, Hockley Co., Labors 16, 17 League 49 Scurry Co. School Land | 140.0 | 59.0 | 1-5 | .... | .... | .... | .... | .... | .... | 43.6 | .... |
| Midland Farms, Andrews Co., 842-T-T-N G&MMB&A | 30.0 | 26.0 | 7 | .... | .... | .... | .... | .... | .... | 162.1 | [11]2.0 |
| North Cowden, Ector Co., 34-5-43-1M T&P RR | 25.0 | 18.0 | 7 | .... | .... | .... | .... | .... | 152.9 | .... | .... |
| Old Ocean, Brazoria Co., Charles Breen League A-46 | 175.0 | 95.0 | 7 | 46.1 | .... | 9.5 | 9.8 | 30.8 | .... | 34.0 | .... |
| Slaughter, Hockley Co., 14-15-59 Edwards & Scurry CSL | 57.0 | 43.0 | 7 | .... | .... | .... | 94.5 | 113.9 | .... | 99.6 | [5]173.6 |
| Texas City, Galveston Co., 1.814 acre tract in John Grant A-72 | 60.0 | 35.0 | 7 | .... | .... | .... | .... | .... | 12.9 | .... | [5]14.4 |
| Wasson ODC $CO_2$, Yoakum Co., 805-D, JH Gibson Survey | 80.0 | 50.0 | 2 | .... | .... | .... | .... | .... | 67.7 | .... | .... |
| West Yantis, Wood Co., 3 Oscar Engledon A-181 | 25.0 | 6.0 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]25.0 |
| ARCO Oil and Gas Co.—*Block 31, Crane Co., 33-31 Univ. Lands | 265.0 | 292.2 | 3-7 | 146.5 | 105.5 | 12.8 | 53.9 | .... | .... | 59.2 | .... |
| Carthage | ... | ... | 3 | 0.3 | 0.6 | 0.4 | 0.7 | .... | .... | 2.5 | .... |
| *Crane, Upton Co., 128-D CCS&RR Co | 15.0 | 8.3 | 3 | 19.8 | 14.8 | 1.8 | 5.3 | .... | .... | 4.4 | [11]1.6 |
| El Dorado, Schleicher Co., 81-TT-TC RR | 15.0 | 13.7 | 7 | 30.3 | 23.4 | 3.9 | 8.9 | .... | .... | 6.6 | [11]4.9 |
| Fashing, Atascosa & Karnes Co., 131 Wm. Smith | 12.0 | 2.7 | [19]5 | .... | 0.1 | .... | 0.2 | .... | .... | 0.5 | .... |
| Longview, Gregg Co., J. Moseley | 35.0 | 10.4 | 7 | 45.8 | 64.4 | 12.8 | 30.9 | .... | .... | 30.1 | [11]1.1 |
| Nueces River, Live Oak Co., Cameron CSL 32-A-34 | 90.0 | 75.1 | 3 | .... | 20.7 | .... | 19.4 | .... | .... | 16.7 | .... |
| Price, Rusk Co., George W. Brooks A-4 | 15.0 | 3.8 | 3-7 | 2.9 | 6.8 | 1.9 | 4.4 | .... | .... | 6.7 | [11]0.8 |
| Silsbee, Hardin Co., George W. Brooks A-4 | 15.0 | 25.5 | 7 | 34.6 | 31.9 | 6.8 | 8.7 | .... | .... | 8.1 | [11]0.7 |
| Taft, San Patricio Co., Coleman Fulton Pasture Land | 40.0 | 15.8 | [26]2 | .... | 3.8 | .... | 3.6 | .... | .... | 3.3 | [11]0.5 |
| Arkla Inc.—Jefferson, Marion Co., Heirs of John Hanks A-188 | 3.0 | 0.6 | 3 | .... | .... | .... | .... | .... | 0.4 | .... | .... |
| Waskom, Harrison Co., J. Blair | 65.0 | NR | 3 | .... | .... | .... | .... | .... | 20.0 | .... | .... |
| Willow Springs, Gregg Co., P. P. Rains | 10.0 | NR | 3 | .... | .... | .... | .... | .... | 6.5 | .... | .... |
| Associated Natural Gas Inc.—Wilcox, Lavaca Co., JR Ragsdale A-377 | 235.0 | 113.4 | [19]2 | 25.2 | 47.9 | 11.8 | 13.1 | .... | .... | 25.7 | .... |
| BHP Petroleum—Diamond M, Scurry Co., se¼ 182-97 H&TC | 18.0 | 13.0 | 6 | 43.2 | 58.2 | 8.0 | 23.4 | .... | .... | 22.6 | [11]0.9 |
| Birthright Gas Processing Ltd.— | | | | | | | | | | | |
| Birthright, Hopkins Co., Linecum A-561 and Hargrave A-426 | 10.0 | 3.5 | 3 | .... | 3.4 | .... | .... | .... | 7.0 | .... | [11]1.8 |
| Black Hawk Gasoline Corp.—Jack Co., R. Stanton, A-1329 | 1.5 | 0.5 | 3&4 | .... | .... | .... | .... | 1.0 | 0.2 | .... | .... |
| Bruin Petroleum Inc.—Clarkson, Sutton Co. | 20.0 | 18.0 | 7 | .... | .... | .... | .... | .... | 36.0 | .... | .... |
| Hainesville, Wood Co. | 6.0 | 4.0 | 3 | .... | .... | .... | .... | .... | 7.0 | .... | .... |
| Trinidad, Henderson Co. | 1.5 | 0.6 | 3 | .... | .... | .... | .... | .... | 1.8 | .... | .... |
| Urbana, San Jacinto Co. | 4.0 | 1.5 | 3 | .... | .... | .... | .... | .... | 2.5 | .... | .... |
| Cabot Transmission Corp.— | | | | | | | | | | | |
| Arrington, Hemphill Co., 62-A-2 H&GNRR | 40.0 | 29.7 | 2 | .... | .... | .... | .... | .... | 37.6 | .... | .... |
| Carson Co., 4-5-I&GN | 20.0 | 14.5 | 7 | .... | .... | .... | .... | .... | 59.4 | .... | .... |
| East Goldsmith, Ector Co., 44-34, 1n,T&PRR | 35.0 | 9.7 | 2-7 | .... | .... | .... | .... | .... | 16.9 | .... | .... |
| Estes, Ward Co., 3-16 Univ. Land | 11.5 | 6.7 | 7 | .... | .... | .... | .... | .... | 39.7 | .... | .... |
| Gray Co., 152-3 I&GN | 20.0 | 12.9 | 7 | .... | .... | .... | .... | .... | 70.6 | .... | .... |
| Kingsmill, Gray Co., 152-3-I&GN | 24.5 | 16.3 | 7 | .... | .... | .... | .... | .... | 84.0 | .... | .... |
| Turkey Creek, Potter Co., 36-M20-G&M | 40.0 | 27.1 | 2 | .... | .... | .... | .... | .... | 84.3 | .... | .... |
| Walton, Winkler Co., 11-26 PSL | 33.5 | 29.4 | 7 | .... | .... | .... | .... | .... | 99.4 | .... | .... |
| Yake-Merchant, Moore Co., NW corner, J.W. Proctor survey | 10.0 | .... | 6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Clajon Gas Co., A&M, Burleson Co., John P. Coles A-12 | 65.0 | 27.8 | 7 | .... | .... | .... | .... | .... | 129.9 | 11.1 | .... |
| La Grange, Fayette Co., James Green A-189 | 200.0 | 55.6 | 7 | .... | .... | .... | .... | .... | 175.6 | 23.9 | .... |
| Conoco Inc.—Chittim, Maurice Co., 35-6 | 5.0 | 1.1 | 3 | .... | 3.2 | .... | 4.5 | .... | .... | 2.2 | .... |
| Hamlin, Fisher Co., 9-R-26 | 15.0 | 11.0 | 7 | .... | .... | .... | .... | .... | 112.0 | .... | .... |
| Ramsey, Reeves Co., nw½ 36-58-1 | 11.0 | 6.5 | 7 | .... | 9.1 | .... | 5.2 | .... | .... | 4.3 | .... |
| Damson Gas Processing Corp.— | | | | | | | | | | | |
| Caddo, Stephens Co., 77 T&P RR 5 | 1.0 | 0.8 | 4 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Cargray, Carson Co., 46-4 I&GN | 30.0 | 11.0 | 7 | 16.3 | 12.8 | .... | .... | .... | 20.4 | .... | .... |
| Ibex, Shackelford Co., nw¼ 28 BAL | 10.0 | 4.5 | [10]1 | .... | 9.7 | .... | 3.3 | .... | .... | 5.9 | .... |
| *Schafer, Carson Co., 88-4-1n I&GN RR | 55.0 | 26.6 | [1]1-7 | .... | .... | .... | .... | .... | 150.6 | .... | [11]0.9 |
| South Bend, Young Co., J. Garrett | 10.0 | 4.5 | [10]1 | .... | 9.7 | .... | 3.3 | .... | .... | 5.9 | .... |
| Sterling Co., 10-22 H&TC | 30.0 | 20.0 | 6 | .... | .... | .... | .... | .... | 53.0 | .... | .... |
| Woodlawn, Harrison Co. | 100.0 | 25.0 | [19]1 | .... | .... | .... | .... | .... | 20.0 | .... | .... |
| Davis Gas Processing Inc.—Big Lake, Reagan Co., 8 miles e of Big Lake | 12.0 | 9.0 | [1]2 | .... | .... | .... | .... | .... | 27.0 | .... | .... |
| Bowie, Montague Co., 3 miles ne of Bowie | 8.0 | 3.0 | 3 | .... | 6.0 | .... | .... | .... | 6.0 | .... | .... |
| Concho, Concho Co., 4 miles s of Paint Rock | 10.0 | 3.0 | [1]2 | .... | 3.5 | .... | .... | .... | 3.5 | .... | .... |
| Irion (Rocker B-2), Irion Co., 8 miles n of Barnhart | 16.0 | 6.0 | [1]2 | .... | .... | .... | .... | .... | 36.0 | .... | .... |
| Neleh, 5 miles sw of McCamey | 8.0 | 3.0 | 6 | .... | .... | .... | .... | .... | 18.0 | .... | .... |
| Robstown, Nueces Co., Fuente A-3, Simmons & Perry subdivision | 8.0 | 3.0 | 7 | .... | .... | .... | .... | .... | 6.0 | .... | .... |
| Stiles, Reagan Co., 5 miles nw of Texon | 8.0 | 3.5 | [1]2 | .... | .... | .... | .... | .... | 22.0 | .... | .... |
| Texon, Reagan Co., 12 miles west of Big Lake | 6.0 | 3.0 | 3 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Davis, J.L.—Claytonville, Fisher Co., 211-3 H&TC RR, 12 mi n of Roscoe | 6.0 | 2.0 | 6 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Peach Creek, Lavaca Co., A-32 | 15.0 | 2.0 | 7 | .... | .... | .... | .... | .... | 6.0 | .... | .... |
| Pearsall, Frio Co., 1-A-307 Henry Castro | 10.0 | 4.0 | 3 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Diamond Shamrock R&M Inc.—McKee, Moore Co., 399-44 H&TC | 375.0 | 187.0 | [19]2-7 | .... | 150.0 | 39.6 | 80.5 | .... | 148.5 | .... | [5]333.0 |

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Eagle Petroleum Corp.—Eagle-Thriftway, Young Co. | 0.5 | 0.2 | 3 | .... | .... | .... | .... | .... | 1.9 | .... | .... |
| Holliday No. 2, Archer Co. | 1.5 | 0.4 | 3 | .... | .... | .... | .... | .... | 1.1 | .... | .... |
| El Paso Natural Gas Co.—Midkiff, Reagan Co., nw4 n2 sw4-22 t-5-s blk. 37 | 168.0 | 56.5 | [19]1 | 72.8 | 133.5 | .... | 55.2 | .... | .... | 49.2 | .... |
| Wilshire, Upton Co., e2 ne4 ne4 & ne4 se4 ne4 135E CCSD & RGNG RR | 30.0 | 18.9 | 4 | .... | .... | .... | .... | .... | 2.2 | .... | .... |
| Endevco Natural Gas Co.—Bear Wallow Brazoria Co., Oliver Jones A-78 | 45.0 | 22.0 | 7 | .... | .... | .... | .... | .... | 22.0 | .... | .... |
| Gun Point, Dewitt Co. | 50.0 | 20.0 | [20]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Seven Sisters, Duval Co. | 35.0 | 2.0 | [20]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Enerfin Partners I Ltd.— | | | | | | | | | | | |
| Bailey, Schleicher Co., 522-TT | 15.0 | 13.3 | 7 | .... | .... | .... | .... | .... | 71.9 | .... | [11]7.5 |
| Eldorado, Schleicher-Irion-Reagan Cos., 33-M-GH&SA | 35.0 | 35.9 | 7 | .... | .... | .... | .... | .... | 54.2 | .... | [11]21.0 |
| Mertzon, Schleicher-Irion-Tom Green Cos., Tom Green CSL-1 | 50.0 | 30.3 | 7 | .... | .... | .... | .... | .... | 134.8 | .... | [11]23.7 |
| Quitman, Wood Co., S.G. Purse A-456 | 6.5 | 3.2 | 3 | .... | .... | .... | .... | .... | 17.8 | .... | [11]0.1 |
| Enron Gas Processing Co.— | | | | | | | | | | | |
| DuBose, Gonzales | 35.0 | 4.0 | [21]1 | .... | .... | .... | .... | .... | .... | .... | [11]0.2 |
| Encinal, Webb Co. | 35.0 | 20.0 | 7 | .... | 15.0 | .... | 9.0 | .... | .... | 7.0 | .... |
| Gregory, San Patricio Co., Geranimo Valdez A-269 | 70.0 | 60.5 | [19]2 | .... | 23.0 | .... | 17.0 | .... | .... | 10.0 | .... |
| Imperial, Crane Co., 20&21 1 H&TC RR-1 | 18.0 | 14.4 | 7 | .... | .... | .... | .... | .... | 45.0 | 0.5 | .... |
| McMullen Co. | 15.0 | 12.6 | [19]2 | .... | 17.0 | .... | 13.0 | .... | .... | 9.0 | .... |
| Martin Co. No. 1, 31-37-2n TYP RR | 10.0 | 8.3 | 3 | .... | .... | .... | .... | .... | 47.5 | .... | .... |
| Martin Co. No. 2 4-HA | 5.0 | 3.3 | 3 | .... | .... | .... | .... | .... | 16.0 | .... | .... |
| Middle Concho, sw4 90-14 H&TC RR Co. | 10.0 | 2.4 | 6 | .... | .... | .... | .... | .... | 13.5 | .... | .... |
| Robstown, Nueces Co., Mathis Garcia A-116 | 80.0 | 32.1 | [19]2 | 10.0 | 25.0 | .... | 16.0 | .... | .... | 9.0 | .... |
| Sonora, Sutton Co., HE&WT RR A-352 | 55.0 | 60.6 | [17]2 | .... | 22.0 | .... | 26.0 | .... | .... | 15.4 | .... |
| Victoria Co., James Reed A-236 | 60.0 | 44.1 | [19]5 | .... | 13.0 | .... | 10.0 | .... | .... | 9.0 | .... |
| Enserch Processing Partners Ltd.— | | | | | | | | | | | |
| Chico, Jack Co., J.U. Fields A-218 | 30.0 | 18.6 | 7 | .... | .... | .... | .... | .... | 74.7 | .... | .... |
| Gordon, Palo Pinto Co., Thomas Reed A-384 | 50.0 | 32.6 | 7 | .... | .... | .... | .... | .... | 126.1 | .... | .... |
| Novice, Coleman Co., T&NO RR Co. 24-2 | 4.5 | 3.2 | 3 | .... | .... | .... | .... | .... | 5.2 | .... | .... |
| Pueblo, Eastland Co., SPRR-464 | 20.0 | 14.5 | 7 | .... | .... | .... | .... | .... | 81.5 | .... | .... |
| Ranger, Eastland Co., H&TC RR 4-4 | 18.0 | 15.2 | 3 | .... | .... | .... | .... | .... | 113.2 | .... | .... |
| Reprieve, Hardeman Co., L. Bechtol, 2 | 3.0 | 1.8 | 3 | .... | .... | .... | .... | .... | [illegible] | .... | .... |
| Santa Anna, Parker Co., Mary Ann Fisk 360, A-195 | 5.0 | 3.8 | 3 | .... | .... | .... | .... | .... | 4.4 | .... | .... |
| Springtown, Parker Co., JL Hodges A-690 | 80.0 | 60.3 | 7 | .... | .... | .... | .... | .... | 196.5 | .... | .... |
| Trinidad, Henderson Co., No. Addison A-17 | 65.0 | 61.5 | 7 | .... | .... | .... | .... | .... | 78.4 | .... | .... |
| Exxon Co. USA—Clear Lake, Harris Co., James Lindsey A-43 | 133.0 | 120.0 | [19]2 | .... | .... | .... | .... | .... | 78.0 | .... | .... |
| Conroe, Montgomery Co., Ransom House | 125.0 | 115.0 | [19]2 | .... | .... | .... | .... | .... | 63.0 | .... | .... |
| Cordona Lake GCF, Crane Co., nw¼ Juan Cordona Survey | 10.0 | 3.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| East Texas, Rusk, T. J. Martin | 25.0 | 5.0 | 3-6 | 12.6 | 24.5 | 6.4 | 15.4 | .... | .... | 16.6 | .... |
| Hawkins, Wood Co., H. Watson | 110.0 | 108.0 | [19]2 | 18.7 | 41.8 | 15.8 | 19.4 | .... | .... | 36.3 | .... |
| Hawkins Cryogenic, Wood Co., H. Watson | 30.0 | 20.0 | 7 | 10.9 | 9.3 | 3.0 | 3.6 | .... | .... | 5.0 | .... |
| Katy, Waller Co., T. S. Reese 110, A-332 | 960.0 | 320.0 | [19]2 | 344.0 | 157.0 | .... | 158.0 | .... | .... | .... | .... |
| King Ranch, Kleberg Co., R. King A-172 | 1,000.0 | 554.0 | [19]2 | 343.7 | 157.8 | 49.2 | 47.2 | .... | .... | 102.7 | .... |
| Means GCF, Andrews Co., PSL A-35 nw corner of 12 | 40.0 | 30.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Neches, Cherokee Co., J. H. Shaw | 30.0 | 25.0 | [19]2 | 6.0 | 9.0 | 1.9 | 5.0 | .... | .... | 9.0 | .... |
| Pyote, Ward Co., 32-16 ULS | 100.0 | 48.6 | [23]5-7 | .... | .... | .... | .... | .... | 65.4 | .... | .... |
| Sabine Lake, Orange Co., Wm. A. Davis A-7 | 25.0 | 12.5 | 7 | .... | .... | .... | .... | .... | 34.0 | .... | .... |
| Tom O'Connor, Refugio Co., Maria Ximines A-324 | 165.0 | 139.0 | 7 | 37.8 | 19.4 | 9.3 | 9.6 | .... | .... | 36.5 | .... |
| Farmland Industries Inc.— | | | | | | | | | | | |
| Bailey, Schleicher Co., 22, Blk. TT | 15.0 | 11.0 | 7 | .... | .... | .... | .... | .... | 105.0 | .... | .... |
| Eldorado, Schleicher Co., 33, Blk. M | 30.0 | 34.0 | 3 | .... | .... | .... | .... | .... | 60.8 | .... | .... |
| Martzon, Irion Co. | 55.0 | 42.0 | 7 | .... | .... | .... | .... | .... | 174.6 | .... | [11]17.6 |
| Fina Oil & Chemical— | | | | | | | | | | | |
| McAllen Ranch, Hidalgo Co. | 26.0 | NR | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Fort Chadbourne Corp.—Box Elmdale, Callahan Co., 4 miles e of Abilene | 4.0 | 2.0 | 3 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Tuscola, Taylor Co., 2 miles w of Tuscola | 4.0 | 2.0 | 3 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Hunt Oil Co.—*Amacker-Tippett, Upton Co., 77&78 blk Y,GC&SF RR survey | 12.0 | 5.7 | 3 | .... | .... | .... | .... | .... | 13.1 | .... | .... |
| *Fairway, Henderson Co., Jose Mora A-497 | 87.5 | 61.2 | [1-40]2 | .... | .... | .... | .... | ... | 112.7 | .... | .... |
| *Pecos Valley, Pecos Co., 106-T&ST-L | 10.0 | 3.1 | 3 | .... | .... | .... | .... | .... | 3.3 | .... | .... |
| Kerr-McGee Corp.—Chapel Hill #35, Smith Co., Stillwell Box A-169 | 35.0 | NR | 7 | .... | 12.2 | .... | 9.7 | .... | 13.3 | .... | .... |
| Hobart Ranch, Hemphill Co., 70 A-2 N&GN | 43.5 | NR | 7 | .... | .... | .... | .... | .... | 73.0 | .... | .... |
| Ladd Petroleum Corp.—Kelton Gas Plant Wheeler Co.,3 blk. A-2,AB&M survey | 20.0 | 17.1 | 7 | .... | .... | .... | .... | .... | 12.6 | .... | .... |
| Southwest Ozona, Crockett Co., 2-2 HGN RR 28 mi sw of Ozona township | 25.0 | 21.5 | [17]2 | .... | .... | .... | .... | .... | 84.2 | .... | .... |
| Wharton, El Campo, A-246 I&GN RR | 20.0 | 18.9 | 7 | .... | .... | .... | .... | .... | 48.3 | .... | .... |
| Mapco Westpan Inc.—Bivins, Moore Co., 33-PMc, ELRR | 100.0 | 21.4 | [46]2 | .... | .... | .... | .... | .... | 57.9 | .... | .... |
| Fritch 950, Hutchinson Co., 92-Y2-TTRR | 60.0 | 27.7 | [45]2 | .... | .... | .... | .... | .... | 107.0 | .... | .... |
| Fritch 1000, Hutchinson Co., 92-Y2-TTRR | 100.0 | .... | [45]2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Marathon Oil Co.—Markham, Matagorda Co., 4-9-9 | 21.0 | 1.6 | 3 | .... | .... | .... | .... | 2.8 | .... | .... | .... |
| Susan Peak, Tom Green Co., 193 SPRR-11 | 3.3 | 2.8 | 3 | .... | .... | .... | .... | .... | 5.6 | 0.5 | .... |
| Welder, San Patricio Co., 49 Robert Montgomery 199 and Ewan Cameron A-97 | 2.0 | 1.5 | 6 | .... | .... | .... | .... | 2.3 | .... | .... | .... |

| | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| *Yates, Pecos Co., I.G. Yates, 194 SF 1234-1 | 72.0 | 69.7 | 3-7 | .... | .... | .... | .... | .... | 60.4 | .... | [11]2.0 |
| Meridian Oil Hydrocarbons Co., Benedum Plant, Upton Co., w2 46 Y MK&T RR | 90.0 | 93.4 | 7 | .... | .... | .... | .... | .... | 427.1 | .... | .... |
| Santa Rosa Plant, Pecos Co., 2-105 8 H&GN RR | 20.0 | 10.6 | 7 | .... | .... | .... | .... | .... | 58.3 | .... | .... |
| Mesa Limited Partnership—Fain, Potter Co., G&M 10-181-B | 80.0 | 62.7 | [1]2-7 | .... | .... | .... | .... | .... | 217.4 | .... | .... |
| Northwest Mendota, Roberts Co., nw/4 sec 3-blk a-1 | 12.0 | 7.4 | 3 | .... | .... | .... | .... | .... | 18.4 | .... | .... |
| Mills Bennett Estate—Brooks Co., El Tule Grant A-257 | 5.0 | 1.1 | 3 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| Mitchell Energy & Development Corp.— | | | | | | | | | | | |
| Alabama Ferry, Madison Co. | 5.0 | 5.5 | 3 | .... | .... | .... | .... | .... | 8.7 | .... | .... |
| Barton Chapel 1, Jack Co. | 15.0 | 8.9 | 7 | .... | .... | .... | .... | .... | 35.0 | .... | .... |
| Barton Chapel 2, Jack Co. | 20.0 | 11.8 | 7 | .... | .... | .... | .... | .... | 46.6 | .... | .... |
| Bridgeport 1, Wise Co. | 150.0 | 111.2 | 7 | .... | 88.6 | 18.0 | 20.0 | .... | 339.8 | 44.3 | [11]8.8 |
| Bridgeport 2, Wise Co. | 20.0 | 14.8 | 7 | .... | 11.8 | 2.4 | 2.7 | .... | 45.3 | 5.9 | [11]1.2 |
| Bridgeport 3, Wise Co. | 20.0 | 14.8 | 7 | .... | 11.8 | 2.4 | 2.7 | .... | 45.3 | 5.9 | [11]1.2 |
| Bryan Hicks, Brazos Co. | 20.0 | 9.6 | 7 | .... | .... | .... | .... | .... | 38.7 | .... | .... |
| Cisco, Eastland Co. | 15.0 | 9.4 | 7 | .... | .... | .... | .... | .... | 46.7 | .... | .... |
| Gum Island, Jefferson Co. | 40.0 | 8.8 | 7 | .... | .... | .... | .... | .... | 27.7 | .... | .... |
| Huckabay No. 1, Erath Co. | 15.0 | 8.5 | 7 | .... | .... | .... | .... | .... | 30.0 | .... | .... |
| Huckabay No. 2, Erath Co. | 15.0 | 8.5 | 7 | .... | .... | .... | .... | .... | 30.0 | .... | .... |
| Huckabay No. 3, Erath Co. | 15.0 | 8.5 | 7 | .... | .... | .... | .... | .... | 30.0 | .... | .... |
| Live Oak, Live Oak Co. | 20.0 | 6.6 | 7 | .... | .... | .... | .... | .... | 18.8 | .... | .... |
| Lone Camp No. 2, Palo Pinto Co. | 10.0 | 3.6 | 7 | .... | .... | .... | .... | .... | 19.5 | .... | [11]<0.1 |
| Lone Camp No. 3, Palo Pinto Co. | 10.0 | 3.6 | 7 | .... | .... | .... | .... | .... | 19.5 | .... | [11]<0.1 |
| Lone Camp No. 4, Palo Pinto | 30.0 | 10.9 | 7 | .... | .... | .... | .... | .... | 58.6 | .... | [11]<0.1 |
| Madison #1, Madison Co. | 20.0 | 15.6 | 7 | .... | .... | .... | .... | .... | 44.8 | .... | .... |
| Madison #2, Madison Co. | 20.0 | 15.6 | 7 | .... | .... | .... | .... | .... | 44.8 | .... | .... |
| Mineral Wells, Palo Pinto Co. | 15.0 | 9.3 | 7 | .... | .... | .... | .... | .... | 52.8 | .... | [11]<0.1 |
| Morgan Mill No. 1, Erath Co. | 15.0 | 4.3 | 7 | .... | .... | .... | .... | .... | 14.8 | .... | .... |
| Morgan Mill No. 2, Erath Co. | 15.0 | 4.3 | 7 | .... | .... | .... | .... | .... | 14.8 | .... | .... |
| Morgan Mill No. 3, Erath Co. | 20.0 | 5.8 | 7 | .... | .... | .... | .... | .... | 19.8 | .... | .... |
| Ponder, Denton Co. | 2.0 | 0.0 | 6 | .... | .... | .... | .... | .... | 3.4 | .... | .... |
| Port Arthur, Jefferson Co. | 115.0 | 80.8 | 7 | .... | .... | .... | .... | .... | 68.3 | .... | .... |
| Port Arthur II, Jefferson Co. | 20.0 | 14.0 | 7 | .... | .... | .... | .... | .... | 11.9 | .... | .... |
| Rockdale, Milam Co. | 20.0 | 0.9 | 7 | .... | .... | .... | .... | .... | 11.9 | .... | .... |
| Seven Oaks, Polk Co. | 20.0 | 4.3 | [26]2 | .... | .... | .... | .... | .... | 5.6 | .... | .... |
| Springtown, Parker Co. | 15.0 | 9.5 | 7 | .... | .... | .... | .... | .... | 23.7 | .... | .... |
| Wellborn, Brazos Co. | 5.0 | 1.9 | 3 | .... | .... | .... | .... | .... | 8.2 | .... | .... |
| Winnie, Jefferson Co. | 75.0 | 63.1 | 7 | .... | .... | .... | .... | .... | 46.8 | .... | .... |
| Mobil Exploration-Producing U.S. Inc.— | | | | | | | | | | | |
| East White Point, San Patricio Co., G.H. Paul subdiv. of Coleman Fulton Pasture Lands | 25.0 | 15.0 | 7 | .... | .... | .... | .... | ... | 21.0 | .... | .... |
| LaGloria, Jim Wells Co., 9-3 Rangeland 7 Herring subdiv. LaGloria Townsite subdiv. | 318.0 | 185.0 | 7 | 187.2 | 116.9 | 28.5 | 28.3 | .... | .... | 57.0 | .... |
| *Lake Creek, Montgomery Co. | 5.5 | 4.5 | 7 | .... | .... | .... | .... | 4.2 | .... | .... | .... |
| *Portillo, San Patricio Co., M. S. Welder | 17.0 | 15.0 | [1]2 | .... | .... | .... | .... | .... | 20.0 | .... | .... |
| Vanderbilt, Jackson Co., R. Musquex A-59 | 60.0 | 57.0 | [1]2 | .... | 6.0 | .... | .... | 15.0 | .... | .... | .... |
| Mobil Oil Corp.—*Coyanosa, Pecos Co., 48-OW TTRR | 125.0 | 125.0 | 7 | .... | .... | .... | .... | .... | 176.4 | .... | .... |
| East Canadian, Hemphill Co., David Crockett | 50.0 | 8.0 | 7 | .... | .... | .... | .... | .... | 20.0 | .... | .... |
| Electra, Wilbarger Co., 17-13 H&TC RR | 1.2 | 0.8 | [19]2 | .... | .... | .... | .... | .... | 12.6 | .... | .... |
| Feldman, Hemphill Co., H&TC RR 42-44 | 3.0 | 3.0 | 6 | .... | .... | .... | .... | .... | 6.3 | .... | .... |
| *Pegasus, Midland Co., e2 30-40-4s T&PRR | 110.0 | 80.0 | 7 | 84.0 | .... | .... | .... | .... | 162.7 | .... | .... |
| Salt Creek, Kent Co., W&NW RR G-193 | 23.0 | 20.0 | 3 | .... | .... | .... | .... | .... | 231.0 | .... | .... |
| Sandhills, Crane Co., Sec. 4, Blk 32, Public School Land | 25.0 | 6.8 | [7-13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| University Waddell, Crane Co., Sec.1, Blk. 31, University Lands | 1.5 | 1.1 | [13-21]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Waha, Pecos Co., 5-C3 PSL | 125.0 | 55.0 | 7 | .... | .... | .... | .... | .... | 121.8 | .... | .... |
| Will-O-Mills, Val Verde Co., Sec. 9, Blk Q4, TCRR | 25.0 | 13.0 | [13-20]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Natural Gas Pipeline Co. of America— | | | | | | | | | | | |
| CP 170, Moore Co., w½ of nw¼ section 1 of TTRR | 80.0 | 60.3 | 7 | .... | .... | .... | .... | .... | 178.8 | .... | .... |
| Oryx Energy Co.—Big Wells, Dimmit Co., I&GN A-223 82-1 | 20.0 | 3.3 | [19]2 | .... | 1.6 | .... | 0.5 | .... | .... | 0.3 | .... |
| Canales, Jim Wells Co., 343 CCSD&R GNG RR A-119 | 40.0 | 17.7 | [19]2 | .... | 8.0 | .... | .... | .... | .... | .... | [5]24.1 |
| *Desdemona, Eastland Co. | NR | 0.8 | 3 | .... | .... | .... | .... | .... | 4.3 | .... | .... |
| Diamond M, Surry Co. | 18.0 | 9.8 | 6 | .... | .... | .... | .... | .... | 114.9 | .... | .... |
| Jameson, Coke Co., 315-1A N&TCRR | 70.0 | 38.0 | 6-7 | .... | 62.8 | .... | 47.1 | .... | .... | 35.6 | [5]153.6<br>[11]1.4 |
| Snyder, Scurry Co., 16-1 JP Smith | 50.0 | 29.1 | 7 | .... | 60.0 | .... | 81.2 | .... | 141.8 | 240.1 | [11]1.2 |
| Sun, Starr Co., 239 AB-225 CCSDR GNG RR | 120.0 | 114.0 | 7 | 68.9 | .... | 44.5 | .... | .... | 38.6 | .... | [5]153.5 |
| Oxy NGL Inc.—Chico, Wise Co., 3 GH&HRR A-384 | 100.0 | 62.0 | 7 | 14.7 | 112.3 | 14.1 | 51.9 | .... | .... | 52.2 | .... |
| East Texas, Gregg Co., William Castleberry A-38 | 27.0 | 23.0 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Eustace, Henderson Co. Vincente Michelli A-465 | 70.0 | 7.8 | 7 | .... | .... | .... | .... | .... | 34.3 | .... | .... |
| Flatrock Creek, Young Co., 6 acres, M. Case A-1402, (File 8 NGL 2630) | 10.0 | 7.3 | 2 | .... | .... | .... | .... | .... | 31.9 | .... | .... |
| Graham, Young Co., 4 acres e 53⅓ acres subdiv 15 TE&L A-3412 (File 10-NGL 2631) | 7.0 | 3.8 | 3 | .... | .... | .... | .... | .... | 2.8 | .... | .... |
| Lefors, Gray Co., 2-1-ACH&B | 11.6 | 8.3 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |

| Company, plant, location | MMcfd<br>Gas capacity | Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mont Belvieu fractionation, Chambers Co., Henry Griffin, League A-12 | .... | .... | † | (1,292.0) | (939.0) | (191.0) | (412.0) | .... | .... | (365.0) | .... |
| Myrtle Springs, Van Zandt Co., J. Salingua A-765 | 25.0 | 23.0 | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Roberts Ranch, Midland Co., 16-41-3s T&PRR | 85.0 | 64.5 | 7 | .... | .... | .... | .... | .... | 83.1 | .... | .... |
| Welch, Dawson Co., 67 M, EL&RR | 3.0 | 1.5 | [26]2 | .... | .... | .... | .... | .... | 14.9 | .... | .... |
| West Seminole, Gaines Co., 335 GCSD & RGNG RR | 30.0 | 11.3 | 7 | .... | .... | .... | .... | .... | 23.5 | .... | .... |
| Permian Operating Ltd. Partnership— | | | | | | | | | | | |
| Possum Kingdom, Stephens Co., E. Romerhausen A-149 | 5.0 | 2.0 | 3 | .... | .... | .... | .... | .... | 5.3 | .... | .... |
| Todd, Crockett, 28-WX GC&SF RR | 5.0 | 3.5 | 3 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Phibro Energy Co.—Bailey, Schleicher Co., 22 Blk. TT | 15.0 | 11.0 | 7 | .... | .... | .... | .... | .... | 105.0 | .... | .... |
| Eldorado, Schleicher Co., 22 Blk. M | 30.0 | 34.0 | 3 | .... | .... | .... | .... | .... | 60.8 | .... | .... |
| Mertzon, Irion Co. | 55.0 | 42.0 | 7 | .... | .... | .... | .... | .... | 174.6 | .... | .... |
| Phillips, Jack L.—Nan Su Gail, Freestone Co. | 7.0 | 1.0 | 3 | .... | .... | .... | .... | .... | 2.0 | .... | .... |
| Phillips 66 Natural Gas Co.— | | | | | | | | | | | |
| Crane Co., ne4 216-F CCSD&RGNG RR | 25.0 | 23.0 | 7 | .... | .... | .... | .... | .... | 169.7 | .... | .... |
| Dumas, Moore Co., nw4-181-44 H&TC | 120.0 | 84.0 | 7 | .... | .... | .... | .... | .... | 359.7 | .... | .... |
| Fullerton, Andrews Co., Center S-17 A-32 PSL | 62.0 | 60.0 | 7 | .... | .... | .... | .... | .... | 524.3 | .... | .... |
| Giddings, Fayette Co., David G. Green A-193 | 75.0 | 73.1 | 3 | .... | .... | .... | .... | .... | 419.7 | .... | .... |
| Goldsmith, Ector Co., nw4-se4-33-44 T&P-1n | 105.0 | 86.0 | 7 | .... | .... | .... | .... | .... | 593.3 | .... | .... |
| Gray Co., e2-32-2 H&GN | 70.0 | 29.0 | 2 | .... | .... | .... | .... | .... | 172.4 | .... | .... |
| Luling, Caldwell Co., north corner John Henry A-12 | 12.0 | 6.6 | 7 | .... | .... | .... | .... | .... | 36.0 | .... | .... |
| Pantex, Hutchinson Co., 8&9 M. Whitley | 20.0 | 14.5 | 7 | .... | .... | .... | .... | .... | 107.6 | .... | .... |
| Puckett, Pecos Co., n2 26-101 TCRR | 94.0 | 56.4 | [6]5 | .... | .... | .... | .... | .... | 1.1 | .... | .... |
| Rock Creek, Hutchinson Co., nw4-22-y A&B | 180.0 | 133.0 | 7 | .... | .... | .... | .... | .... | 540.7 | .... | .... |
| Sherman, Hansford Co., 7&8-1 PSL | 250.0 | 193.0 | 7 | .... | .... | .... | .... | .... | 621.9 | .... | .... |
| Spraberry, Midland Co., se4-25 3s-37 T&P | 27.5 | 27.5 | 7 | .... | .... | .... | .... | .... | 470.9 | .... | .... |
| Portal Drilling Co.—McMullen Co., Benjamin Odlum A-9 | 2.2 | .... | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pronto Gas Products Inc.—Archer City, Archer Co. | 1.0 | 0.1 | 3 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| Moran, Shackelford Co. | 1.0 | 0.5 | 3 | .... | .... | .... | .... | .... | 1.5 | .... | .... |
| Wall, Tom Green Co. | 0.8 | 0.2 | 3&6 | .... | .... | .... | .... | .... | 1.2 | .... | .... |
| Seagull Energy Corp.—Matagorda Co., Lot 29 Moore Pasture subdivision | 250.0 | 230.0 | 7 | 59.7 | 50.2 | 28.0 | 14.8 | .... | .... | 35.7 | .... |
| Allen Hill, Tom Green Co. 10, blk 22 | 1.5 | 0.6 | 6 | 0.1 | 0.3 | <0.1 | 0.2 | .... | .... | 0.3 | .... |
| Shannon Energy Corp.—Mobeetie, Wheeler Co. (Gasoline plant) 46-BLK A-5 H&GN | 2.3 | 1.1 | 3 | .... | .... | .... | .... | .... | 4.1 | .... | .... |
| Gas collection system | 5.0 | 1.2 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Shell Western E&P Inc.—Armadillo, Pecos Co., GC&SF R-3-5 | 2.0 | 1.3 | 2 | .... | .... | .... | .... | .... | 3.0 | .... | .... |
| Big Foot, Frio Co. | 0.5 | 0.2 | 3 | .... | .... | .... | .... | .... | 0.8 | .... | .... |
| *Bryans Mill, Cass Co., B.F. Lynn A-651 | 70.0 | 51.3 | 2 | .... | 22.0 | .... | .... | 35.8 | .... | .... | .... |
| Denver Unit $CO_2$, Yoakum Co., nw¼ 827 sw¼ 802-D John H. Gibson | 140.0 | 139.6 | 2 | 43.9 | 66.0 | 12.0 | 30.5 | .... | .... | 43.5 | .... |
| Fandango, Zapata Co. | 90.0 | 75.0 | [29]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Houston Central, Colorado Co., F. Mayhar A-400 K. Winn A-589 | 700.0 | 541.0 | 2-7 | 224.9 | 218.1 | 55.9 | 65.7 | .... | .... | 135.2 | .... |
| Tippett, Crockett Co., 38-31-H&TC RR | 55.0 | 19.3 | 6 | 30.8 | 21.6 | .... | .... | 30.1 | .... | .... | .... |
| TXL, Ector Co., 17-45-1s T&P RR | 40.0 | 22.5 | 2 | 24.3 | 38.1 | .... | 15.8 | .... | .... | 18.7 | .... |
| Wasson, Yoakum Co., nw¼ 827 sw¼ 802-D, John H. Gibson | 95.0 | 44.5 | 2 | 37.9 | 82.3 | .... | .... | 117.8 | .... | .... | .... |
| Sid Richardson Carbon & Gasoline Co.—Chalk, Cottle Co., nw¼ of C.L. Carter FP 4480 | 15.0 | 6.1 | 3 | .... | .... | .... | .... | .... | 11.6 | .... | [11]1.1 |
| Eskota, Fisher Co., 11 T&PRR-19 | 12.0 | 5.6 | 6 | .... | .... | .... | .... | .... | 48.0 | .... | [12]0.2 |
| Halley, Winkler Co., e2-22-BT1-PSL | 60.0 | 21.6 | 7 | .... | .... | .... | .... | .... | 75.9 | .... | [11]1.2 |
| Keystone, Winkler Co., 5-B2 & 1&2 B3-PSL | 120.0 | 141.5 | 7 | .... | .... | .... | .... | .... | 389.3 | .... | [11]1.8<br>[12]0.5 |
| SPG Exploration Corp.—Martha F. Berry, Frio Co., M.C. Patton, 1178 A-542 | 5.0 | 3.0 | 6 | .... | .... | .... | .... | .... | 7.0 | .... | .... |
| Ozona, Crockett Co., nw¼ BMN GC&SF RR | 60.0 | 25.0 | [19]2 | .... | 33.0 | .... | 15.5 | .... | .... | 8.0 | .... |
| Tejas Gas Corp., Copano, Aransas | 20.0 | 20.0 | 7 | .... | .... | .... | .... | 33.0 | .... | .... | .... |
| Tenneco Natural Gas Liquids Corp.— | | | | | | | | | | | |
| Chesterville, Colorado Co., Thomson A-708 | 80.0 | 41.4 | 2 | .... | .... | .... | .... | .... | 22.6 | .... | .... |
| Magnolia City, Nueces Co. | 60.0 | 49.5 | 7 | .... | .... | .... | .... | .... | 58.3 | .... | .... |
| Texaco Inc.—Bradford Ranch, Midland Co., 13-39-3s, T&P RR | 16.0 | 17.5 | 7 | .... | .... | .... | .... | .... | 67.8 | .... | [11]1.6 |
| George West, Live Oak Co., G.W. West sub D 200&201 | 23.0 | 19.1 | 6-7 | .... | .... | .... | .... | .... | 55.2 | .... | [11]0.1 |
| Handy, Grayson Co., se¼ I&GN RRA-1441 | 12.0 | 0.9 | [19]2 | .... | .... | .... | .... | .... | 7.2 | .... | .... |
| *Headlee Devonian, Ector-Midland Co., ne¼ of nw¼ 29-41-2s T&PRR | 190.0 | 187.5 | 7 | .... | .... | .... | .... | .... | 341.8 | .... | .... |
| Mabee, Andrews Co., s¼ 32-40-2n, G&MMB&A | 5.0 | 2.6 | 6 | .... | .... | .... | .... | .... | 9.2 | .... | .... |
| Ozona, Crockett, n½ 3-MN, GC&SF RR | 25.0 | 14.4 | 7 | .... | .... | .... | .... | .... | 51.7 | .... | .... |
| South Kermit, Winkler Co., sw¼ 22 B-3, PSL | 42.0 | 12.0 | 7 | .... | .... | .... | .... | .... | 34.3 | .... | [11]0.8 |
| Streetman, Freestone Co., A-536, Jefferson Richards | 7.5 | 2.2 | 6-7 | .... | .... | .... | .... | .... | 10.0 | .... | .... |
| Texaco Producing Inc.— | | | | | | | | | | | |
| East Vealmoor, Howard Co., 20-27-H&TC | 50.0 | 33.8 | [19]2 | 117.0 | 127.1 | 15.4 | 49.6 | .... | .... | 52.9 | [11]1.6 |
| Fuller, Scurry Co., ne¼ 652-97 H&TC RR | 5.0 | 4.0 | 3 | .... | .... | .... | .... | .... | 43.9 | .... | .... |
| McLean, Gray Co., 68-23 H&GN RR | 26.0 | 12.1 | 7 | .... | .... | .... | .... | .... | 24.3 | .... | [11]0.1 |
| Spearman, Ochiltree Co., 23-R-B&B | 50.0 | 39.3 | 2 | .... | 12.8 | .... | .... | .... | 13.9 | .... | [11]<0.1 |
| Texas Oil & Gas Corp— | | | | | | | | | | | |
| Booker, Lipscomb Co., w[illegible] sw4 1116-43 H&TC RR | 6.0 | .... | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Coyanosa, Pecos Co., 18-143-T&SL RR | 75.0 | 50.7 | 7 | .... | .... | .... | .... | .... | 86.1 | .... | [11]0.4 |

| | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Denton Co., BBB&CRR A-161 | 30.0 | 7.5 | [19]2 | .... | .... | .... | .... | .... | 25.6 | .... | [11]0.2 |
| East Texas, Marion Co., John H. Kernels A-236 | 75.0 | 20.1 | 7 | .... | ... | .... | .... | .... | 19.6 | .... | [11]0.9 |
| Grapeland, Houston Co., 2 JDJ Procella League A-69 | 165.0 | .... | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Laredo, Webb Co., Porcion 14 of N.D. Hachar Estate | 30.0 | 9.7 | [19]2 | .... | .... | .... | .... | .... | 10.2 | .... | [11]0.4 |
| Longview, Gregg Co., Frost Thorn A-5 | 100.0 | 0.0 | 7 | .... | .... | .... | .... | .... | .... | .... | [11]0.1 |
| Shackelford, Callahan Co., nw corner 24 sw corner 23 Bayland Orphan Home Land | 30.0 | 9.5 | [19]2 | .... | .... | .... | .... | .... | 33.2 | .... | [11]0.1 |
| Three Rivers, Live Oak Co., J.D. Jamison 168 A-268 | 25.0 | 2.1 | 7 | .... | .... | .... | .... | .... | 5.4 | .... | [11]0.4 |
| Union Pacific Resources—Bryan, Brazos | 35.0 | 21.0 | 6 | .... | .... | .... | .... | .... | 175.2 | .... | .... |
| Conger, Glasscock Co. | 6.0 | 3.0 | 3 | .... | .... | .... | .... | .... | 6.3 | .... | .... |
| *Conroe, Montgomery Co. | 65.0 | 44.0 | 7 | .... | .... | .... | .... | .... | 42.0 | .... | .... |
| East Texas, Panola Co. | 420.0 | 390.0 | 7 | .... | .... | .... | .... | .... | 391.7 | 72.5 | [5]300.0 |
| Gulf Plains, Nueces | 135.0 | 99.0 | 7 | 106.1 | 51.8 | .... | 32.8 | .... | .... | 73.8 | .... |
| Lyons 1 & 2, Burleson Co. | 25.0 | 8.3 | 3 | .... | .... | .... | .... | .... | 41.7 | .... | .... |
| Tunis, Burleson Co. | 15.0 | 6.6 | 3 | .... | .... | .... | .... | .... | 16.5 | .... | .... |
| Union Ridge Oil & Gas Corp.— | | | | | | | | | | | |
| Kosciusko, Wilson Co., l mile n of Kosciusko, Tex. | 8.0 | 2.0 | 3 | .... | ... | .... | .... | .... | 4.0 | .... | .... |
| Jupiter, Jack Co., 3 miles south of Cundiff, Tx. | 5.0 | 4.1 | 3 | .... | .... | .... | .... | .... | .... | 10.0 | .... |
| Longhorn, Archer Co., 5 miles south of Wichita Falls, Tx. | 3.0 | 1.3 | 3 | .... | .... | .... | .... | .... | .... | 6.0 | .... |
| Union Texas Petroleum Corp.—Benedum, Upton Co., Sect. G, C. Bendle A-657 | 30.0 | 29.2 | 7 | 91.3 | 65.5 | 7.4 | 22.7 | .... | .... | 27.6 | .... |
| East Sour Lake, Hardin Co., 384 A-764 J.F. Keith | 20.0 | 17.8 | 7 | 5.1 | 16.1 | 5.3 | 5.0 | ... | .... | 6.3 | .... |
| Noel, Eastland Co., ne 4 31-3 H&TC RR | 30.0 | 18.8 | 7 | 55.0 | 42.4 | 5.6 | 14.5 | ... | .... | 15.7 | .... |
| Perkins, Coke Co., 2-H&TC RR | 25.0 | 20.4 | 7 | 55.0 | 50.0 | 7.7 | 16.8 | .... | .... | 17.7 | .... |
| Walnut Bend, Grayson Co., E.L. Stickney A-1089 | 10.0 | 5.8 | 7 | 16.0 | 13.2 | 2.0 | 5.4 | .... | .... | 5.9 | .... |
| Wellman, Terry Co. | 6.0 | 1.7 | 7 | 2.7 | 6.7 | 1.1 | 3.5 | .... | .... | 4.8 | .... |
| United Texas Transmission Co.—Galveston Bay, Chambers Co., J. Armstrong A-2 | 40.0 | 4.5 | 7 | .... | .... | .... | .... | .... | 1.9 | .... | [11]0.2 |
| Unocal—Dollarhide, Andrews Co., 25-A52-PSL | 13.0 | 5.2 | 6 | .... | .... | .... | .... | .... | 47.6 | .... | .... |
| *Fort Trinidad, Houston, Co., RCS A-23 | 40.0 | 10.8 | [38]2 | .... | 8.3 | ... | 6.4 | .... | .... | 5.8 | .... |
| North Riley, Gaines Co., 365-g-CCSDRGNG | 2.5 | 1.5 | 3 | .... | .... | .... | .... | .... | 8.6 | .... | .... |
| Van, Van Zandt Co., JWS A-891 | 15.0 | 10.8 | [38]2 | .... | 6.9 | .... | 10.0 | .... | .... | 12.1 | .... |
| Upham Oil & Gas Co.—Bridgeport, Wise Co., Wm. Hersee | 12.0 | 6.0 | 2 | .... | 7.4 | .... | 4.7 | .... | 5.5 | .... | .... |
| Valero Hydrocarbons Co.—Armstrong, DeWitt Co. James A. Moody A-333 | 400.0 | 332.5 | 2-7 | 225.1 | 134.8 | 29.5 | 39.7 | .... | .... | 52.4 | .... |
| Freer, Webb Co. BS 1-4 A-1954 | 190.0 | 165.5 | 2 | 22.3 | 43.8 | 14.3 | 16.1 | .... | .... | 25.9 | .... |
| Garden City, Sterling Co., 30-22, A-698 H&TC RR | 40.0 | 40.0 | 3-7 | 77.6 | 69.5 | 8.0 | 21.7 | .... | .... | 15.1 | .... |
| Gilmore, Hidalgo Co., TexMex RR A-211 | 90.0 | 67.8 | 7 | 55.6 | 30.7 | 10.7 | 9.1 | .... | .... | 19.8 | .... |
| Ozona, Crockett Co., 10 45- DP GC&SF RR | 20.0 | 13.5 | 5-7 | 9.7 | 9.9 | 1.6 | 3.3 | .... | .... | 3.3 | .... |
| San Martin, Bexar Co. 4010 F. Farias 15 A-2 | 150.0 | 116.4 | 7 | 72.4 | 56.1 | 14.1 | 19.7 | .... | .... | 28.5 | .... |
| Shoup, Nueces Co., AB&M 409 A-555 | 300.0 | 257.4 | 3-7 | 192.9 | 103.1 | 31.7 | 29.4 | .... | .... | 54.7 | .... |
| Sonora, Sutton Co., 122, HE&WTRR A-1117 | 44.0 | 30.4 | 7 | 24.1 | 21.6 | 3.7 | 7.4 | .... | .... | 8.0 | .... |
| Sterling plant and field, 11 2-31-5 South T&PRY | 40.0 | 27.9 | 3-5-7 | 45.0 | 42.1 | 5.1 | 13.4 | .... | .... | 9.6 | .... |
| Warren Petroleum Co.— | | | | | | | | | | | |
| Breckenridge, Stephens Co., n2 22 LAL | NR | 11.0 | 7 | .... | .... | .... | .... | .... | 58.0 | .... | .... |
| Canadian, Hemphill Co., 216 G&MMB&A-C | NR | 9.8 | 7 | .... | .... | .... | .... | .... | 24.2 | .... | .... |
| Como, Hopkins Co., Nacogdoches Univ. A-703 | NR | 19.4 | 7 | .... | 11.0 | .... | 9.8 | .... | 4.7 | .... | [11]39.4 |
| Fashing, Atascosa and Karnes Cos., Emma Tar H. et al, tract in James Wilkerson 149 A-882 | NR | 45.0 | [19]2 | .... | 13.4 | .... | 9.8 | .... | .... | 19.6 | .... |
| Gladewater, Gregg Co., David Ferguson | NR | 5.9 | 7 | .... | .... | .... | .... | .... | 46.2 | .... | [5]32.7<br>[11]0.3 |
| Monahans, Ward Co., 4-F | NR | 15.2 | 7 | .... | .... | .... | .... | .... | 81.6 | .... | .... |
| Moores Orchard, Fort Bend Co., German Emigration No. 8 A-117 | NR | 7.5 | 7 | .... | .... | .... | .... | .... | 13.9 | .... | .... |
| Sand Hills, Crane Co., 21-PSL B-21 | NR | 85.5 | [19]2-7 | .... | .... | .... | .... | .... | 360.8 | .... | .... |
| Shackelford Co., TE&L 522 & 523 | NR | 8.9 | 7 | .... | .... | .... | .... | .... | 50.0 | .... | .... |
| Sherman North, Grayson Co., Uriah Burns A-121 | NR | 5.5 | [19]2 | .... | 5.9 | .... | .... | .... | 5.3 | .... | [11]1.0 |
| Sherman South, Grayson Co., James S. Coffee A-232 | NR | 1.1 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]0.2 |
| Spear, Gregg & Rusk Co., Mary Van Winkler | NR | 1.1 | 7 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| Tonkawa, Hemphill Co., 78-41 H&TC RR | NR | 2.1 | 3 | .... | .... | .... | .... | .... | 2.2 | .... | [11]0.2 |
| Worsham, Ward Co., 56-34 H&TC RR | NR | 6.0 | 7 | .... | .... | .... | .... | .... | 16.4 | .... | .... |
| West Texas Gas Inc.—Markley, Jack Co. | 12.0 | 2.0 | 4 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| WW Sub Inc.—*Markley, Jack Co., SPRR A-583 | 2.0 | .7 | 3 | .... | .... | .... | .... | .... | 2.8 | .... | .... |
| **Total** | **16,621.4** | **10,691.3** | | **3,477.7** | **3,325.5** | **563.5** | **1,544.1** | **396.7** | **15,270.6** | **2,249.6** | **1,420.1** |

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† Fractionation. (Figures in parenthesis do not represent primary production, and are not added in state totals). §Butane-gasoline mix.

## UTAH

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chevron USA Inc.—Red Wash, Uintah Co., ne4 21 nw4 22-7s-23e | 7.0 | 5.3 | [7]2 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| Coastal Oil & Gas Corp.—Altamont, Duchesne Co., 34-1s-4w | 40.0 | 16.7 | 3 | .... | 10.9 | .... | 8.6 | .... | .... | 22.5 | .... |
| Gary-Williams Energy Corp.—Bluebell, Duchesne Co., sw-nw 23-1s-2w | 23.0 | 11.1 | [19]2 | .... | 12.2 | .... | .... | .... | 22.9 | .... | .... |

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Koch Hydrocarbon Co.—Cedar Rim, Duchesne Co., 21-35-6w | 12.0 | 4.1 | 3 | .... | 2.7 | .... | 2.4 | .... | .... | 4.4 | .... |
| Marathon Oil Co.—Tin Cup Mesa, San Juan Co., 2s-38s-25e | 1.5 | 1.5 | 3 | .... | .... | .... | .... | .... | 4.2 | .... | .... |
| Phillips 66 Natural Gas Co.—Bridger Lake, Summit Co., 25-3n-14e | 34.0 | 22.0 | 7 | .... | .... | .... | .... | .... | 31.8 | .... | .... |
| Questar Pipeline Co.—Price, Carbon Co., 8-14s-10e | 120.0 | 89.3 | 3 | .... | .... | .... | .... | .... | 4.8 | .... | .... |
| Texaco Inc.—Aneth, San Juan Co., nw4-6-t41s-r24e | 100.0 | 6.9 | [17]1 | ... | 29.8 | .... | .... | .... | 30.2 | .... | [11]1.3 |
| Union Pacific Resources—Pineview, Summit Co., 3-2n-7e | 25.0 | 2.0 | 3 | .... | 4.0 | .... | ... | .... | 11.2 | .... | .... |
| Yellow Creek, Summit Co. 16-3n-8e | 80.0 | 41.0 | 7 | .... | 16.9 | .... | .... | .... | 12.8 | .... | .... |
| Unocal—*Lisbon, San Juan Co., 22-30s-24e | 80.0 | 59.1 | 3 | .... | 19.1 | .... | 11.8 | .... | .... | 16.9 | .... |
| Western Gas Processors Ltd.—Four Corners, San Juan Co., se1/4 sec19 24e 38s | 15.0 | 7.9 | 3 | .... | .... | .... | .... | .... | 16.2 | .... | [11]0.4 |
| **Total** | **537.5** | **266.9** |  | .... | **95.6** | .... | **22.8** | .... | **135.1** | **43.8** | **1.7** |

## WEST VIRGINIA

| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Columbia Gas Transmission Corp.—Cobb, Kanahwa Co., Big Sandy district | 35.0 | 29.5 | [19]2 | .... | .... | .... | .... | .... | 21.5 | .... | .... |
| Kenova, Wayne Co., Ceredo district | 140.0 | 116.5 | [19]2 | .... | .... | .... | .... | .... | 187.7 | .... | .... |
| CNG Transmission Corp.—Hastings, Wetzel Co. | 150.0 | 123.8 | 3 | 235.6 | 143.7 | 24.1 | 44.8 | .... | 45.8 | .... | .... |
| Pennzoil Products Co.—7 small plants | 7.0 | 3.0 | 4 | .... | .... | .... | .... | .... | 1.2 | .... | .... |
| Tejas Gas Corp.—Copley Run, Lewis Co. | 40.0 | 31.0 | 7 | .... | .... | .... | .... | 38.2 | .... | .... | .... |
| Schultz, Pleasants Co. | 10.0 | 8.1 | 7 | .... | .... | .... | .... | 24.0 | .... | .... | .... |
| West Union, Doddridge Co. | 15.0 | 13.0 | 7 | .... | .... | .... | .... | 26.0 | .... | .... | .... |
| **Total** | **397.0** | **324.9** |  | **235.6** | **143.7** | **24.1** | **44.8** | **88.2** | **256.2** | .... | .... |

## WYOMING

| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Production Co.—*Anschutz Ranch East, Uinta Co., 26-24-35 13n-121w 6PM | 600.0 | 600.0 | 7 | .... | .... | .... | .... | .... | 1,167.2 | .... | .... |
| *Bairoil-Wertz, Sweetwater Co., 7-26n-90w | 150.0 | 100.0 | 1-3-4 | .... | .... | .... | .... | .... | 40.0 | .... | .... |
| Beaver Creek, Fremont Co. 10-33n-96w | 65.0 | 23.0 | [19-42]2 | .... | .... | .... | 9.0 | 8.8 | .... | 8.7 | .... |
| Beaver Creek Phosphoria, Fremont Co., 10-33n-96w | 14.0 | 6.0 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]0.7 |
| Elk Basin, Park Co., 29-48n-99w | 17.0 | 9.0 | [19-44]2 | .... | .... | .... | 14.4 | 14.6 | .... | 17.0 |  |
| Painter NRU-NGL, Uinta Co., sw¼ 32 16n-119w | 240.0 | 198.0 | 7 | .... | .... | .... | .... | .... | 523.0 | .... | .... |
| Salt Creek Gas Plant, Natrona Co., w/half of s35 (t-40n, r-79w). | 2.0 | 2.0 | 1-3 | .... | .... | .... | .... | 2.7 | 5.6 | .... | .... |
| Whitney Canyon, Uinta Co., 17-17n-119w | 275.0 | 183.0 | 7 | .... | .... | .... | .... | .... | 171.9 | .... | [11]134.1 |
| ARCO Oil & Gas Co.—Gillette, Campbell Co., 18-50n-73w | 31.0 | 7.1 | 3 | .... | 14.6 | .... | 7.9 | .... | .... | 7.1 | [11]0.3 |
| Riverton Dome, Fremont Co., 36-1s-4e | 30.0 | 4.3 | [28]2 | .... | .... | .... | .... | .... | .... | 0.8 | .... |
| Chevron USA Inc.—Carter Creek, Uinta Co., 6-18n-119w | 150.0 | 129.0 | [7]2 | .... | .... | .... | .... | .... | 65.7 | .... | [11]109.2 |
| Colorado Interstate Gas Co.—Rawlins, Carbon Co., sw4-sw4 25-21n-86w | 200.0 | 216.0 | [19]2 | .... | 32.4 | .... | 42.6 | .... | .... | 22.0 | .... |
| Enerfin Partners I Ltd.—Gillette, Campbell Co., 1-49n-74w | 6.0 | 1.4 | 3 | .... | 3.3 | .... | .... | .... | 4.2 | .... | .... |
| Enron Gas Processing Co.—Painter, Uinta Co. nw4 6-15n-119w | 35.0 | 38.7 | 3 | .... | .... | .... | .... | .... | 44.4 | .... | .... |
| Exxon Co. USA—Shute Creek, Lincoln Co., 22n-112w-14 | 550.0 | 520.0 | [35]1<br>[29]2<br>[23]5<br>6-7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Garret Petroleum Co. Rock River, Carbon Co., 34-19n-78w | 0.5 | 0.2 | 3 | .... | .... | .... | .... | .... | 0.4 | .... | .... |
| John Brown E&C Inc.—NPR 3 Teapot Dome, Natrona Co., swne 4 38n-78w | 10.0 | 9.0 | 3 | .... | 3.0 | .... | .... | .... | 0.3 | 7.5 | .... |
| KN Energy Inc.—Casper, Natrona Co., 10-33n-78w | 80.0 | 43.2 | 1 | .... | 13.0 | .... | 4.2 | .... | .... | 3.1 | .... |
| Flat Top, Converse Co., 20-33n-68w | 5.0 | 1.6 | 1 | ... | 2.4 | .... | .... | 2.7 | .... | .... | .... |
| Marathon Oil Co.—Oregon Basin, Park Co., 29-51n-100w | 6.5 | 5.0 | 3 | .... | .... | .... | .... | ... | 14.5 | .... | .... |
| Northwest Pipeline Corp.—Moxa Arch, Lincoln Co., 19-19n-112w | 30.0 | 21.1 | [31]5 | .... | .... | .... | .... | .... | 2.4 | .... | .... |
| Opal, Lincoln Co., 27-21n-114w | 425.0 | 260.0 | [19]2-7 | .... | 86.0 | .... | 35.3 | .... | 55.9 | 39.1 | .... |
| Oryx Energy Co.—Lucky Ditch, Uinta Co., 18-t12n-r11w | 15.0 | 6.9 | 3 | .... | .... | .... | .... | .... | 8.3 | .... | .... |
| Sun Ranch Federal, Natrona Co.—15-33n-86w | 5.0 | 1.9 | 3 | .... | .... | .... | .... | .... | 2.1 | .... | .... |
| Oxy U.S.A.Inc.—Red Desert, Sweetwater Co., 7-t19n-r96w | 48.0 | 0.0 | 7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Phillips Petroleum Co.—Douglas, Converse Co., se4-ne4 34-33n-71w | 95.0 | 47.0 | 7 | .... | .... | .... | .... | .... | 241.1 | .... | .... |
| Ralston Processing Associates Inc.—Oregon Basin, Park Co., 8-51n-100w | 15.0 | 6.2 | 7 | .... | 2.4 | .... | 1.9 | .... | .... | 1.2 | .... |
| Union Pacific Resources—*Brady, Sweetwater Co., 11-16n-101w | 65.0 | 58.0 | [19]2 | .... | 17.0 | 7.6 | 14.2 | .... | .... | 17.8 | .... |
| Emigrant Trail, Uinta Co., 1-16n-113w | 60.0 | 37.0 | 7 | .... | .... | .... | .... | .... | 43.4 | .... | .... |
| Manning, Converse Co., 15-39n-73w | 3.0 | 0.3 | 3 | .... | .... | .... | .... | .... | 0.4 | .... | .... |
| Patrick Draw, Sweetwater Co., 25-19n-99w | 25.0 | 18.0 | 7 | .... | 14.6 | 3.2 | 5.0 | .... | .... | 5.9 | .... |
| Unocal—Worland, Washakie Co., 17-48n-92w | 15.0 | 12.9 | 7 | .... | 12.4 | .... | 7.4 | .... | .... | 4.9 | .... |

| Company, plant, location | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Western Gas Processors Ltd.—Amos Draw, Campbell Co., se¼ nw¼ 32-1n-75w | 32.5 | 19.4 | 3 | .... | .... | .... | .... | .... | 38.0 | .... | [11]1.6 |
| Hartzog Draw, Campbell Co., nw¼ ne¼ 11-45n-76w, 6th PM | 6.0 | 7.8 | 3 | .... | .... | .... | .... | .... | 21.2 | .... | [11]3.4 |
| Hilight, Campbell Co., 26 sw14-45n-71w | 60.0 | 18.0 | 3 | .... | 25.4 | .... | 13.6 | .... | 8.4 | .... | [11]1.0 |
| Lincoln Road, Sweetwater Co., 107 w17n | 45.0 | 28.0 | 3 | .... | .... | .... | .... | .... | 43.9 | .... | .... |
| Newcastle, Weston Co., n2-nw4 9-42n-64w | 5.0 | 3.0 | 3 | .... | 9.6 | .... | .... | 10.4 | .... | .... | [11]1.0 |
| Oedekoven, Campbell Co. 45 55n-73w | 12.0 | 3.9 | 3 | .... | 0.7 | .... | .... | 1.3 | 3.2 | .... | [11]<0.1 |
| Spearhead, Converse Co., 13-79n-75w | 21.0 | 7.6 | 2 | .... | .... | .... | .... | .... | 13.3 | .... | .... |
| Woods Petroleum Corp.—*Powell, Converse Co., 38-39-40n 73&74w | 40.0 | 33.5 | 3 | .... | .... | .... | .... | 33.0 | .... | .... | .... |
| **Total** | **3,469.5** | **2,687.0** | | .... | **236.8** | **10.8** | **155.5** | **73.5** | **2,518.4** | **135.1** | **257.4** |

## ABU DHABI

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Abu Dhabi Gas Industries Ltd.— | | | | | | | | | | | |
| *Asab NGL extract, Western Region | 306.0 | 180.0 | 2-7 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Bu Hasa NGL extract, Western Region | 396.0 | 284.0 | 2-7 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ruwais NGL | .... | .... | † | .... | .... | .... | .... | .... | .... | .... | .... |
| Abu Dhabi Gas Liquefaction Co. Ltd.— | | | | | | | | | | | |
| Zakum, Umm Shaif, Bunduo, Das Island | 450.0 | 465.0 | 1-3-4<br>5-6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Abu Dhabi National Oil Co.— | | | | | | | | | | | |
| Habshan, Thamama C onshore area | 450.0 | 340.0 | [7]1 | .... | .... | .... | .... | .... | .... | 546.0 | .... |
| **Total** | **1,602.0** | **1,269.0** | | .... | .... | .... | .... | .... | .... | **546.0** | .... |

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†Fractionation. 22,000 tons day NGL capacity.

## ALGERIA

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sonatrach—Camel plant, Arzew | NR | 170.0 | 4-7 | .... | .... | .... | .... | 218.6 | .... | .... | .... |
| Hassi R'Mel, Laghouat, Module 0 | NR | 1,578.0 | NR | .... | .... | .... | .... | .... | .... | .... | [11]2,309.0 |
| Hassi R'Mel, Laghouat, Module 1 | NR | 2,085.2 | 6 | .... | .... | .... | .... | .... | .... | .... | [11]3,140.2 |
| Skikda | NR | 435.0 | 4-7 | .... | .... | .... | .... | 414.2 | .... | .... | .... |
| **Total** | **5,335.2** | **4,268.2** | | .... | .... | .... | .... | **632.8** | .... | .... | **5,449.2** |

## ARGENTINA

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gas del Estado—Cañadón Alfa, Tierra del Fuego | 52.9 | 74.6 | [13]1-3-4 | .... | .... | .... | .... | .... | .... | 17.7 | .... |
| Cañadón Piedras, Tierra del Fuego | 52.9 | 45.2 | [13]1-3-4 | .... | .... | .... | .... | .... | .... | 7.9 | .... |
| Cañadón Seco, Caleta Olivia, Santa Cruz | 17.7 | 21.2 | [13]1-[16]2 | .... | 6.4 | .... | 7.6 | .... | .... | 5.3 | .... |
| Caimancito, Ledesma, Snata Cruz | 35.3 | 56.5 | [13]1-[16]2 | .... | 11.9 | .... | 12.9 | .... | .... | 6.7 | .... |
| Centenario, Neuquén | 17.7 | 17.7 | [13]1-[16]2-4 | .... | 8.2 | .... | 8.6 | .... | .... | 7.3 | .... |
| Chimen Aike, Rio Gallegos, Santa Cruz | 28.2 | 28.2 | [35]1-3 | .... | .... | .... | .... | .... | .... | 14.7 | .... |
| El Huemul, Pico Truncado, Santa Cruz | 63.6 | 35.3 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| El Medanito, Colonia Catriel, Neuquen | 45.9 | 21.2 | [35]1-3-4 | .... | .... | .... | .... | .... | .... | 8.7 | .... |
| Loma de la Lata, Neuquén | 211.9 | 222.5 | [23]5-7 | .... | 102.1 | .... | 67.5 | .... | .... | 85.4 | .... |
| Planta McKee, Buenos Aires | 176.6 | 155.4 | [13]1-[17]2 | .... | 25.0 | .... | 26.0 | .... | .... | 30.0 | .... |
| Planto Etano, Buenos Aires | 635.6 | 678.0 | 4-[23]5-7 | 687.7 | 343.6 | .... | 212.2 | .... | .... | 95.2 | .... |
| Plaza Huincul, Cutralco, Neuquén | 17.7 | 17.7 | 3-4-[31]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.8 |
| Rio Neuquén, Neuquén | 105.9 | 109.5 | 4-[31]5 | .... | .... | .... | .... | .... | .... | 40.9 | .... |
| Sierra Barrosa, Neuquén | 26.5 | 15.9 | 4-[31]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **1488.4** | **1,498.9** | | **687.7** | **497.2** | .... | **334.8** | .... | .... | **319.8** | **0.8** |

## AUSTRALIA

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Esso Australia Ltd.— | | | | | | | | | | | |
| Gippsland No. 1, Longford, Victoria | 370.0 | 170.0 | [19]2 | 93.0 | 147.0 | .... | 83.0 | .... | .... | 182.0 | .... |
| Gippsland No. 2, Longford, Victoria | 367.0 | 170.0 | 7 | 93.0 | 147.0 | .... | 83.0 | .... | .... | 182.0 | .... |
| Gippsland No. 3, Longford, Victoria | 370.0 | 170.0 | 7 | 93.0 | 147.0 | .... | 83.0 | .... | .... | 182.0 | .... |
| Santos Ltd.—Moomba, Cooper Basin | 666.0 | 466.0 | [14]1-[23]5-7 | .... | .... | .... | .... | 610.3 | .... | 512.5 | .... |
| Woodside Offshore Petroleum PL— | | | | | | | | | | | |
| Withnell Bay, Burrup Peninsula, Karratha, n of w Australia | 800.0 | 400.0 | 7 | .... | .... | .... | .... | .... | .... | .... | [11]850.0 |
| **Total** | **2,573.0** | **1,376.0** | | **279.0** | **441.0** | .... | **249.0** | **610.3** | .... | **1,056.5** | **850.0** |

## AUSTRiA

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **OeMV AG—Aderklaa, Lower Austria** | **17.5** | **13.7** | **7** | .... | .... | .... | .... | **26.7** | .... | **26.4** | .... |

## BAHRAIN

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bahrain National Gas Co.—Jebel Al-Dukhan | 168.0 | 155.0 | [19]2 | .... | .... | .... | .... | 25.6 | .... | .... | .... |
| **Total** | **168.0** | **155.0** | | .... | .... | .... | .... | **25.6** | .... | .... | .... |

## BANGLADESH

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bakhrabad Gas Systems Ltd.— | | | | | | | | | | | |
| *Muradnagar Upazilla 1, Comilla District | 60.0 | 58.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Muradnagar Upazilla-2, Comilla District | 180.0 | 120.0 | [31-32] 5 | .... | .... | .... | .... | .... | .... | .... | [11]8.2 |
| **Total** | **240.0** | **178.0** | | .... | .... | .... | .... | .... | .... | .... | **8.2** |

## BOLIVIA

| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Yacimientos Petroleos Fiscales Bolivanos—Colpa plant, Andres Ibanez Province Santa Cruz | 192.0 | 18.0 | [13]1 | .... | .... | .... | .... | 7.8 | .... | 5.7 | [11]11.0 |

| Company, plant, location | ——— MMcfd ——— | | Process/ condition method | ——— Production—1,000 gpd (Average based on the past 12 months) ——— | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gas capacity | Gas through-put | | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| *Rio Grande plant, Cordillera Province, Santa Cruz | 282.0 | 159.3 | [13]1 | .... | 1.4 | 2.5 | .... | 153.9 | .... | 55.8 | [11]125.9 |
| **Total** | **474.0** | **177.3** | | .... | **1.4** | **2.5** | .... | **161.7** | .... | **61.5** | **136.9** |

## BRAZIL

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Petrobrás— | | | | | | | | | | | |
| Asfor, Ceará | 12.0 | 6.2 | [47]2 | .... | .... | .... | .... | 18.3 | .... | 3.2 | .... |
| Atalata, Sergipe | 70.0 | 100.0 | [47]2 | .... | .... | .... | .... | 170.4 | .... | 49.4 | .... |
| Cabiúnas, Rio de Janeiro | 19.5 | 18.2 | [47]2 | .... | .... | .... | .... | 38.2 | .... | 5.4 | .... |
| Cabiúnas, Rio de Janeiro | .... | .... | †8 | .... | .... | .... | .... | 8.8 | .... | 8.4 | .... |
| Candeias, Bahia | 70.0 | 80.0 | [47]2 | .... | .... | .... | .... | .... | 120.0 | .... | .... |
| Carmopolis, Sergipe | 12.3 | 7.0 | 6 | .... | .... | .... | .... | .... | 5.3 | .... | .... |
| Catu, Agua Grande, Bahia | 50.0 | 58.0 | [47]2 | .... | .... | .... | .... | .... | 84.3 | .... | .... |
| Guamaré, Rio Grande do Norte | 70.6 | 70.0 | [47]2 | .... | .... | .... | .... | 148.0 | .... | 26.2 | .... |
| Lagoa Parda, Espírito Santo | 5.3 | 10.0 | 3 | .... | .... | .... | .... | 10.0 | .... | 5.0 | .... |
| Rio de Janeiro I | 70.0 | 47.6 | [47]2 | .... | .... | .... | .... | 80.8 | .... | 24.8 | [11]9.6 |
| Rio de Janeiro II | 70.0 | 36.6 | 7 | 0.9 | .... | .... | .... | 44.7 | .... | 12.9 | .... |
| **Total** | **449.7** | **433.6** | | **0.9** | .... | .... | .... | **519.1** | **209.6** | **135.3** | **9.6** |

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†396,000 g/d condensate capacity, 28,125 g/d condensate throughput. Stabilization process.

## BRUNEI

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Brunei Shell Petroleum Co. Sdn. Bhd.—Seria | 82.0 | 67.4 | 4 | .... | .... | .... | .... | .... | .... | .... | |
| Brunei LNG Sendirian Berhad—Lumut | 950.0 | 765.0 | 6 | .... | 9.4 | .... | .... | .... | 50.1 | 252.1 | .... |
| **Total** | **1,032.0** | **832.4** | | .... | **9.4** | .... | .... | .... | **50.1** | **252.1** | .... |

# Canada

## Alberta

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AEC Oil and Gas.— | | | | | | | | | | | |
| *A-1 Station, Suffield, 4-3-19-9 w4m | 30.0 | 14.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| A-2 Station, Suffield, 16-15-20-8 w4m | 20.0 | 7.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| AB Station, Suffield, 16-16-20-6 w4m | 30.0 | 11.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| B1 Station, Suffield, 14-15-20-5 w4m | 25.0 | 15.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| B-2 Station, Suffield, 14-15-20-4 w4m | 50.0 | 30.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| C Station, Suffield, 1-4-15-8 w4m | 50.0 | 40.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Craigend, 9-25-64 14 w4m | 13.0 | 13.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| D Station, Suffield, 1-4-15-6 w4m | 70.0 | 40.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| E Station, Suffield, 4-3-18-9 w4m | 25.0 | 16.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hythe-Brainard, Sour 14-18-74 12 w6m | 75.0 | 50.0 | [33-34]1-[2]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Hythe-Brainard, Sweet 11-18-74-12 w6m | 55.0 | 18.0 | [35]1-4-6 | .... | .... | .... | .... | 0.4 | .... | .... | .... |
| Island Lake, 10-21-67 24 w4m | 4.0 | 4.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Keg River, 7-12-103 24 w5m | 35.0 | 17.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Koomati Station, Suffield, 4-4-17-4 w4m | 120.0 | 65.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Tweedie, 11-5-68 12 w4m | 10.0 | 7.8 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Valhalla Solution, Grande Prairie, 16-18-74-08 w6m | 6.0 | 4.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Alberta Natural Gas Co. Ltd.— | | | | | | | | | | | |
| *Cochrane, ne¼, 16-26-4 5w5m | 1,300.0 | 1,300.0 | 6-7 | 1,715.0 | .... | .... | .... | .... | 655.0 | .... | .... |
| Altana Exploration Co.— | | | | | | | | | | | |
| Caroline, 12-36-34-6-w5m | 12.0 | 6.3 | [19]2 | .... | 2.8 | .... | 2.7 | .... | .... | 8.2 | .... |
| Monitor, 10-3-35-4-w4m | 9.0 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Niton, 10-16-55-13-w5m | 5.0 | 0.4 | 3 | .... | .... | .... | .... | 0.5 | .... | .... | [11]0.2 |
| Saddle Lake, 16-26-57-13-w4m | 5.0 | 0.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Altex Resources Ltd.— | | | | | | | | | | | |
| Delburne, LSD 10-8-37-23 w4m | 18.0 | 5.8 | 3-4 | .... | .... | .... | .... | .... | 5.1 | .... | .... |
| Penhold, LSD 10-30-36-27 w4m | 6.5 | 4.6 | 3-4 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Amoco Canada Petroleum Co. Ltd.— | | | | | | | | | | | |
| Ante Creek-1, nw 18-65-23 w5m | 10.0 | 1.3 | [19]1-3-4 | .... | .... | .... | .... | .... | 9.6 | .... | .... |
| Ante Creek 4-13, LSD 4 13-65-24 w5m | 2.0 | 0.8 | 3 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Ante Creek Dunvegan-3, LSD 10 4-66-23 w4m | 10.0 | 2.2 | 3 | .... | .... | .... | .... | .... | 1.7 | .... | .... |
| Arrowwood North, 4-15-21-25 w4m | 7.9 | 2.1 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Arrowwood South, Hussar, 1-7-20-25 w4m | 24.9 | 4.1 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Athabasca East, 9-23-66-22 w4m | 9.0 | 4.2 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Atlee-Buffalo, 12-21-20-8 w4m | 4.0 | 0.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Baptiste (Athabaska N.),5-18-67-22w4m | 11.3 | 2.1 | [7]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Baptiste, 8-18-68-23 w4 | 4.0 | 0.8 | [21]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Big Bend, 2-7-67-26 w4 | 10.0 | 2.3 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bigoray (Pekisko), 6-28-51-8 w5m | 13.2 | 5.5 | [21]1-3 | .... | .... | .... | .... | .... | .... | 1.6 | .... |
| *Bigoray 13-9, 13-9-52-8 w5m | 1.7 | .... | 3 | .... | .... | .... | .... | .... | 9.7 | .... | .... |
| Bigstone D-3, sw¼ 10-61-22 w5m | 55.7 | 32.0 | [33]1-3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bigstone Dunvegan, se 10-61-22 w5m | 18.0 | 17.8 | 3-4 | .... | .... | .... | .... | .... | 35.2 | .... | .... |
| Bolloque, 16-23-64-26 w4m | 10.0 | 2.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bouvier, 15-29-70-24 w4m | 5.2 | 0.8 | [21]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Braeburn, 16-19-77-10 w6m | 5.6 | .... | [7]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Brazeau (Elk River), 4-6-47-12 w5m | 7.0 | 1.7 | [7-13]1-3-4 | .... | .... | .... | .... | .... | 0.3 | .... | .... |
| Brazeau River, 1-46-14 w5m | 218.2 | 83.5 | [7]1-3 | .... | .... | .... | .... | .... | 41.0 | .... | .... |
| Cache, 1-32-59-13 w4m | 15.0 | 6.5 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Caroline North, 1-11-35-6 w5m | 74.3 | 40.9 | [13-20]1-3 | .... | 22.4 | 21.1 | .... | .... | .... | 35.1 | .... |
| Caroline South, 3-20-34-4 w5m | 47.7 | 26.2 | [7-13]1-2 | .... | 14.9 | 16.9 | .... | .... | .... | 28.0 | .... |
| Cessford, 2-8-24-12 w4m | 128.0 | 23.6 | 3-4 | .... | .... | .... | .... | .... | .... | 3.2 | .... |
| Cherhill, 4-24-56-5 w5m | 7.0 | 5.3 | [7]1-2 | .... | .... | .... | .... | .... | 6.5 | .... | .... |
| Craigend, 16-1-64-13 w4m | 5.0 | 2.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cranberry, 1-24-96-5 w6m | 88.3 | 43.1 | [7-13]1-3-4 | .... | .... | .... | .... | .... | 40.5 | 59.7 | .... |
| Duvernay, 11-11-55-12 w4m | 14.6 | 3.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Eaglesham, 2-14-77-25 w5 | 4.0 | 1.9 | [7-13]2-3 | .... | .... | .... | .... | .... | 1.6 | .... | .... |
| D-1, East Crossfield, n¼ 14-28-1 w5m | 105.9 | 48.9 | [33]1-3-4 | .... | .... | .... | .... | .... | 3.4 | 12.3 | .... |
| East Crossfield, ne¼ 14-28-1 w5m | 45.0 | .... | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |

| Company, plant, location | MMcfd<br>Gas capacity | Gas throughput | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Edson, 3&4 11-53-18 w5m | 372.5 | 125.0 | $^{7-13}$1-3-4 | .... | .... | .... | .... | .... | .... | 47.6 | .... |
| Edward, 7-12-62-17 w4m | 2.5 | 0.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ellerslie, sw¼-4-52-25 w4m | 315.0 | 155.6 | 3-4<br>$^{23}$5-7 | 459.1 | 212.7 | 78.7 | .... | .... | .... | 37.5 | .... |
| Empress I & II, sw¼ 12-20-1 w4m | 3,500.0 | 2,800.0 | 3-4<br>$^{23}$5-7 | 1,962.5 | 745.8 | 283.4 | .... | .... | .... | 119.9 | .... |
| Enchant, 11-9-14-16 w4m | 7.0 | 6.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Fir, ne¼ 32-58-21 w5m | 60.0 | .... | $^{13}$1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Flat Lake, 11-17-67-18 w4m | 6.5 | 1.1 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Frenman, 11-21-64-9 w4m | 8.0 | 4.6 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Garrington, 11-17-34-3 w5m | 15.0 | 5.2 | $^{13}$1-3-4 | .... | 10.6 | 5.8 | .... | .... | 2.5 | .... | .... |
| Gilby North, 9-12-41-4 w5m | 4.2 | 1.2 | $^{13}$1-3-4 | .... | .... | .... | .... | .... | .... | 0.7 | .... |
| Gilby South, 8-26-40-3 w5m | 6.4 | 4.6 | 4-$^{8}$5 | .... | .... | .... | .... | .... | .... | 2.1 | .... |
| Granada, Pembina, LSD 2 16-52-11 w5m | 30.0 | 17.0 | 3 | .... | .... | .... | .... | .... | 25.8 | 0.3 | .... |
| Haight Mundare, 6-8-53-16 w4m | 7.0 | 1.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hilda, 16-22-17-2 w4m | 6.0 | 2.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hollow, 10-22-61-20 w4m | 10.0 | 2.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hotchkiss East, 6-6-94-1w6 | 12.7 | 1.5 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hotchkiss MD, 11-29-94-25 w5m | 191.1 | 8.1 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hotchkiss North, 2-35-94-2 w6m | 22.6 | 13.4 | $^{33}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hotchkiss South, 9-34-93-01 w6m | 22.1 | 3.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hylo, 12-65-15 w4m | 3.3 | 1.5 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Inland, 4-25-51-15 w4m | 7.5 | 2.2 | $^{13}$1-3-4 | .... | .... | .... | .... | .... | .... | 10.8 | .... |
| Inland South, 15-31-50-14 w4m | 9.0 | 1.6 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Jenner, 10-34-19-9 w4m | 14.0 | 7.5 | $^{7-13}$1-3-4 | .... | .... | .... | .... | .... | .... | 1.5 | .... |
| Josephine, ne¼ 1-83-10 w6m | 50.0 | 8.7 | 3 | .... | .... | .... | .... | .... | .... | 5.0 | .... |
| *Kaybob South 1, 1-12-62-20 w5m | 225.6 | 81.6 | $^{7-13}$1-3-4 | .... | 118.3 | 74.5 | .... | .... | .... | 162.6 | .... |
| *Kaybob South 2, 3&4 12-62-20 w5m | 169.1 | 24.5 | $^{7}$1 3-4 | .... | .... | .... | .... | .... | 91.6 | 118.4 | .... |
| Kaybob South (West Fox Creek), 13-22-60-19 w5m | 15.7 | 5.6 | 3 | .... | .... | .... | .... | .... | 3.2 | .... | .... |
| Kirby, nw 25-73-5 w4m | 53.0 | 33.2 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Kirby Lake, 12-8-74-5 w5m | 44.8 | 29.2 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Lanaway, 13-5-36-4 w5m | 15.0 | .... | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Lavoy, 11-12-52-14 w4m | 15.9 | 4.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Leaman, 4-10-56-11 w5 | 17.7 | 7.1 | 3 | .... | .... | .... | .... | .... | 5.7 | 2.4 | .... |
| Leismer, 21 77-8 w5m | 27.0 | 27.2 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Little Bow, 16-13-14-18 w4m | 20.0 | 5.3 | $^{7-13}$1-3-4 | .... | .... | .... | .... | .... | .... | 0.6 | .... |
| Lobstick, sw¼ 17-50-7 w5m | 44.1 | 32.2 | 3-4 | .... | .... | .... | .... | .... | 28.7 | 1.1 | .... |
| Lone Pine Creek, 6-23-30-28 w4m | 74.0 | 15.4 | $^{7}$1-3-4 | .... | .... | .... | .... | .... | .... | 24.4 | .... |
| Majorville, 4-31-18-19 w4 | 10.8 | 8.9 | 3 | .... | .... | .... | .... | .... | .... | 1.9 | .... |
| Mannville, 3-27-50-9 w4m | 33.9 | 11.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Markerville, 10-6-36-2 w5m | 15.0 | .... | $^{13}$1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Marten Hills, 18-76-25 w4m | 142.3 | 31.9 | 4-$^{23}$5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Meanook, 6-10-63-22 w4m | 26.5 | 3.7 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Medicine Hat, 2-27-15-4 w4m | 12.0 | 4.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Medicine Hat North, 1-7-16-2 w4m | 4.5 | 2.2 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Medicine River, 6-16-38-4 w5m | 6.5 | 4.0 | 3-4 | .... | 0.5 | 1.2 | .... | .... | .... | 1.6 | .... |
| *Nipisi, 4 11-80-8 w5m | 44.1 | 0.4 | $^{20}$1-3<br>$^{23}$4-5 | .... | .... | .... | .... | .... | 158.1 | 0.6 | .... |
| Nipisi (Mitsue), 12-30-72-4w5 | 25.0 | .... | 3-4-6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Oyen, 14-36-28-5 w4 | 4.0 | 0.6 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Patricia, 13-5-21-12 w4m | 7.9 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pembalta 1, ne¼ 25-48-7 w5m | 8.2 | 4.8 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pembalta 2, e½ 15-47-7 w5m | 16.0 | 10.4 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pembalta 7, sw¼ 34-47-9 w5m | 13.7 | 6.6 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pembalta 8, sw¼ 5-49-9 w5m | 10.9 | 2.5 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pembina, 10-25-45-9 w5 | 1.0 | 0.6 | 3 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| Pembina (Keystone), 6-15-48-3 w5m | 7.5 | 4.1 | 3-4 | .... | 2.6 | 3.4 | .... | .... | .... | 3.1 | .... |
| Pouce Coupe, 11-19-79-11 w6 | 11.7 | 8.8 | 3 | .... | .... | .... | .... | .... | .... | 6.0 | .... |
| Provost, 13-9-33-8 w4 | 1.7 | 0.5 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Provost, ne¼-19-36-5 w4m | 80.0 | 22.8 | 5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Provost (Amisk), 1-22-41-8-w4m | 10.0 | 1.2 | 3-4<br>$^{7-13}$5 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Provost (Brownfield), se¼-2-39-12 w4m | 10.6 | 11.5 | 3-4-$^{8}$5 | .... | .... | .... | .... | .... | .... | 1.2 | .... |
| *Provost (Castor East), 4-3-38-13 w4m | 19.9 | 6.3 | 4-$^{8}$5 | .... | .... | .... | .... | .... | .... | 0.4 | .... |
| Provost (Choice), 13-17-40-9 w4m | 10.0 | 1.6 | 4-5 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Provost (Consort), 8-19-36-5 w4m | 75.8 | 21.3 | $^{13}$1-4 | .... | .... | .... | .... | .... | .... | 3.7 | .... |
| Provost East, 3-30-37-2 w4m | 9.5 | 4.0 | 3 | .... | .... | .... | .... | .... | .... | 0.6 | .... |
| Provost (Monitor), 2-3-35-5 w4m | 6.5 | 0.5 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ranfurly, 14-32-50 12 w4m | 15.9 | 15.9 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Richdale, 7-9-12 w4m | 10.0 | 4.0 | 3-4 | .... | .... | .... | .... | .... | .... | 0.4 | .... |
| *Ricinus, 11-30-35-8 w5m | 22.2 | 39.6 | 3-4<br>$^{23}$5-7 | .... | 96.0 | 53.0 | .... | .... | .... | 61.1 | .... |
| Route, 7-16-62-8 w6m | 70.0 | 12.5 | $^{13}$2-4 | .... | .... | .... | .... | .... | 7.0 | .... | .... |
| Sinclair, sw 19-72-11 w6m | 70.0 | 32.8 | $^{13}$1-3-4 | .... | .... | .... | .... | .... | .... | 9.8 | .... |
| St. Albert, 14 36-53-26 w4m | 2.0 | 0.1 | $^{7-13}$1-3-4 | .... | .... | .... | .... | .... | 1.5 | .... | .... |
| South Wapiti, ne 36-67 9 w6m | 298.4 | 188.3 | $^{8-32}$5 | .... | .... | .... | .... | .... | .... | 39.3 | .... |
| Steele, 10-19-77-24 w4m | 8.9 | 2.3 | $^{13-23}$1-5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sturgeon Lake South, se 2-69-22 w5m | 22.8 | 11.2 | $^{33}$1-3-4 | .... | .... | .... | .... | .... | 8.5 | 13.3 | .... |
| Sundance, 6-25-54-21 w5m | 15.6 | 15.1 | 3 | .... | .... | .... | .... | .... | .... | 9.8 | .... |
| Sundance, 7-9-54-21 w5 | 6.0 | 2.3 | 3-$^{15}$5 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Sylvan Lake, 10-12-38-3 w5m | 4.0 | 1.4 | 3 | .... | 0.3 | 0.4 | .... | .... | .... | 0.6 | .... |
| Sylvan Lake, 14-32-37-3 w5m | 54.0 | 26.4 | $^{7}$1-3 | .... | 23.2 | 1.6 | .... | .... | .... | 11.2 | .... |
| Tangent, 16-20-80-24 w5m | 7.5 | 2.7 | $^{7}$1-3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Three Hills Creek, nw½ 13-35-26 w4m | 12.0 | 3.6 | 3-4 | .... | .... | .... | .... | .... | 6.1 | .... | .... |
| Tower North, 6-14-76-16 w4m | 7.0 | 4.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Twining, sw 31-32-24 w4m | 8.3 | 4.5 | 3 | .... | .... | .... | .... | .... | .... | 5.1 | .... |
| Valhalla, 1-29-75-9 w6m | 31.8 | 21.2 | 3-4 | .... | .... | .... | .... | .... | .... | 3.3 | .... |
| Vulcan, se¼-24-15-22 w4m | 55.2 | 30.6 | $^{21}$1-$^{7-33}$2<br>3-4 | .... | .... | .... | .... | .... | .... | 7.3 | .... |
| Wandering River, 9-30-72-14 w4m | 11.9 | 1.9 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Warwick, 10-18-53-14 w4m | 8.4 | 2.1 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Waskahigan, ne7-64-23 w5m | 16.3 | 10.8 | $^{13}$1-3-4 | .... | .... | .... | .... | .... | 7.7 | .... | .... |
| Wembley, 6-19-73-8 w6 | 99.0 | 22.9 | $^{7}$1-3<br>4-7 | .... | .... | .... | .... | .... | 57.4 | 129.6 | .... |

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Whitelaw, 13-20-81-1 w6m | 10.0 | 0.6 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Willesden Green, 27-42-8 w5m | 40.0 | 21.6 | 3-7 | .... | 12.9 | 12.7 | .... | .... | .... | 8.9 | .... |
| *Windfall, 8-17-60-15 w5m | 421.6 | 84.0 | [7]1-3-4 | .... | .... | .... | .... | .... | .... | 66.4 | .... |
| Worsley, 7-22-87-7 w6m | 56.7 | 0.5 | [19]1-3 | .... | .... | .... | .... | .... | .... | 0.6 | .... |
| Zama, nw 12-116-6 w6m | 25.6 | 8.4 | [7-13]1-2-4 | .... | .... | .... | .... | .... | 8.2 | 8.0 | .... |
| Anderson Exploration Ltd.— | | | | | | | | | | | |
| Belloy, 16-3-78-1 w6m | 9.0 | 8.5 | 4-[28]5 | .... | .... | .... | .... | .... | .... | 1.0 | .... |
| Bruce, 10-1-48-15 w4m | 3.0 | 2.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Buff Coulee, 11-12-47-7 w4m | 8.0 | 7.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Dunvegan, 15-3-81-4 w6m | 240.0 | 125.0 | 3-4-7 | .... | .... | .... | .... | .... | 85.0 | 38.0 | .... |
| Hines, LSD 6-35-85-3 w6m | 8.0 | 7.5 | 4-[28]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Dixonville, 8-14-85-25 w4m | 4.0 | 2.6 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Kitscoty, 10-17-51-3 | 2.0 | .... | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Lloydminster, 7-11-51-1 w4m | 2.0 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Manyberries, 10-1-5-5 w4m | 2.5 | 1.8 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Mirage, 10-2-79-8 w4m | 1.5 | 0.2 | 3-4 | .... | .... | .... | .... | .... | .... | 0.2 | .... |
| Paradise, Omega, 8-24-46-02 w4m | 5.0 | 3.8 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Woking, 11-30-75-4 w6m | 4.5 | 1.8 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ausquacan Energy Ltd.—Bantry, LSD 4 33-17-12 w4m | 12.4 | 5.5 | 2 | <0.1 | 0.3 | .... | 0.8 | .... | .... | 2.7 | .... |
| Bumper Development Corp. Ltd.—Bumper Crystal, Wetaskiwin, 16-36-45-4 w5m | 4.0 | 1.5 | 3 | .... | .... | .... | .... | .... | 3.0 | .... | .... |
| Bumper Rose Creek, Wetaskiwin, 8-13-45-7 w5m | 5.0 | 3.5 | [13]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Canadian Hunter Exploration Ltd.— | | | | | | | | | | | |
| Basset Station 1, ne¼ 29-104-2 w6m | 7.0 | 3.6 | [32]5 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Basset Lake South, ne¼ 29-106-5 w6m | 4.0 | 2.7 | 3 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Elmworth Deep Cut, se¼ 8-70-11 w6m | 275.0 | 185.0 | 7 | .... | .... | .... | .... | 233.0 | .... | .... | .... |
| Elmworth Shallow Cut, se¼ 8-70-11 w6m | 300.0 | 190.0 | [31]5 | .... | .... | .... | .... | .... | .... | 21.5 | .... |
| Haig River, nw¼ 33-104-5 w6m | 5.4 | 2.3 | 3 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Karr, nw¼ 10-65-2 w6m | 50.0 | 31.0 | 3 | .... | 8.2 | .... | 9.5 | .... | .... | 26.2 | .... |
| South Gold Creek, nw¼ 15-66-5 w6m | 15.0 | 1.9 | [35]1 | .... | .... | .... | .... | .... | .... | 0.6 | .... |
| Canadian Natural Resources.— | | | | | | | | | | | |
| Calling Lake South, 1-20-70-20 w4m | 10.0 | 4.3 | [7-35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Killam, Flagstaff 29, LSD 12-23-42-11 w4m | 20.0 | 1.0 | 4-[31]5 | .... | .... | .... | .... | <0.1 | .... | .... | .... |
| Canadian Occidental Petroleum Ltd.— | | | | | | | | | | | |
| Carrot Creek, 2-26-52 12 w5m | 14.0 | 9.0 | 3 | .... | .... | .. | .... | §15.2 | .... | .... | .... |
| Keystone, 5 35-46-4 w5m | 10.0 | 4.0 | 2 | .... | 1.8 | .. | 1.8 | .... | .... | 1.9 | .... |
| Mazeppa, se¼ 35-19-28 w4m | 42.4 | 17.7 | [33]2 | .... | .... | .... | .... | .... | .... | .... | [11]17.4 |
| Paddle River, LSD 13, 6-57n-8 w5m | ... | ... | [7]1-7 | 10.9 | 16.9 | .... | 9.5 | .... | .... | 7.3 | .... |
| Petrogas Processing, Crossfield, s½ 2-26-29 w4m | 210.0 | 74.0 | [7]1 | .... | 34.3 | .... | 24.3 | .... | .... | 44.9 | .... |
| Chevron Canada Resources— | | | | | | | | | | | |
| *Acheson, 5-2-53-26 w4m | 17.7 | 6.0 | 7 | 3.5 | 4.4 | .... | 2.7 | .... | .... | 1.5 | .... |
| *Bigoray, 10-7-51-9 w5m | 3.0 | NR | [3]1-3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Brazeau, 16-35-48-12 w5m | 24.8 | 16.4 | 3-4<br>[23]5-7 | .... | .... | .... | .... | .... | 35.4 | .... | [5]87.5 |
| Chinchaga, 5-32-98-7 w6m | 30.0 | 18.0 | [3-13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ferrybank, 14-11-45-27 w4m | 5.2 | 4.0 | 3-4 | .... | .... | .... | .... | .... | 3.0 | .... | .... |
| Joffre, 14-36-38-27 w4m | 9.0 | 0.5 | 3-4 | .... | .... | .... | .... | .... | 0.7 | .... | .... |
| House Algar, 16-1-82-17 w4m | 7.5 | 2.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Kaybob South No. 3, 15-59-18 w5m | 445.0 | 303.5 | [3]1-[19]2-4<br>[23]5-7 | .... | .... | .... | .... | 89.3 | .... | 274.6 | [5]340.8 |
| *Mitsue, 11 30-72-4 w5m | 30.2 | 33.0 | [19]2-4 | .... | .... | .... | .... | .... | 349.8 | .... | .... |
| North Gilby, 1-24-41-3 w5m | 23.0 | 9.3 | 3-[32]5 | .... | .... | .... | .... | 11.0 | .... | .... | .... |
| Pouce Coupe, 6-30-79-11 w6m | 13.9 | 11.4 | 3-4 | .... | .... | .... | .... | 9.1 | .... | .... | .... |
| Princess, 12-12-20-12 w4m | 13.0 | 4.6 | [3]1-[32]5 | .... | .... | .... | .... | .... | .... | 0.9 | .... |
| Sylvan Lake, 1-21-38-2 w5m | 31.5 | 17.7 | [19]2 | .... | 16.8 | .... | 11.3 | .... | .... | 9.4 | .... |
| *West Pembina, 11-22-49-12 w5m | 32.0 | 21.8 | [3]1-3-4 | .... | .... | .... | .... | 30.2 | .... | 32.9 | .... |
| Chieftain Development Co. Ltd.— | | | | | | | | | | | |
| Chisholm, 11-2-69 1 w5m | 4.0 | 4.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cooperative Energy Development Corp.— | | | | | | | | | | | |
| Blackie, 06-15-20-27 w4m | 4.0 | 1.0 | [13-26]2-4 | .... | .... | .... | .... | .... | 1.0 | .... | .... |
| Carrot Creek, LSD 10-16-53-13 w5m | 8.0 | 6.0 | [13-26]2-4 | .... | .... | .... | .... | .... | 8.0 | .... | .... |
| Edson 1-13, LSD 1-13-54-19 w5m | 10.0 | 6.0 | [13-26]2-4 | .... | .... | .... | .... | .... | 9.0 | .... | .... |
| Edson North, LSD 16-15-53-18 w5m | 8.0 | 4.5 | [13-26]2-4 | .... | .... | .... | .... | .... | 5.6 | .... | .... |
| Edson South, 10-30-52-17 w5m | 1.5 | 1.0 | [13-26]2-4 | .... | .... | .... | .... | .... | 1.5 | .... | .... |
| Iosegun 4-15, LSD 4-15-65 20 w5m | 6.0 | 4.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Iosegun 10-23, LSD 10-23-65-20 w5m | 10.0 | 8.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Iosegun 10-27, LSD 10-27-65-20 w5m | 6.0 | 4.0 | [13]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Medicine River, LSD 10-14-39-3 w5m | 6.0 | 6.0 | [13-26]2-4 | .... | .... | .... | .... | .... | 7.5 | .... | .... |
| DeKalb Petroleum Corp.— | | | | | | | | | | | |
| Blueberry Mountain, 11-16-82-7 w6m | 10.0 | 5.0 | 5 | .... | .... | .... | .... | .... | .... | 1.5 | .... |
| Bingley, 2-36-40-7 w5m | 2.6 | 2.6 | 6 | .... | .... | .... | .... | .... | 4.0 | .... | .... |
| Garrington, 13-5-34-3 w5m | 12.0 | 5.0 | 7 | .... | .... | .... | .... | .... | 6.5 | .... | .... |
| Leafland, 15-31-39-5 w5m | 23.5 | 10.0 | 7 | .... | .... | .... | .... | .... | 13.0 | 13.0 | .... |
| Nevis, 12-7-41-22 w4m | 27.0 | 10.0 | [11]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Enron Oil Canada Ltd.— | | | | | | | | | | | |
| Greencourt East/Thunder, 9-20-59-6 w5m | 7.0 | 5.6 | 3 | .... | .... | .... | .... | 2.4 | .... | .... | .... |
| Highvale, 10-4-51-4 w5m | 8.0 | 5.7 | 3 | .... | .... | .... | .... | 2.4 | .... | .... | [11]0.5 |
| Esso Resources Canada Ltd.—Battle Lake, 3-23-46-2 wsm | 1.8 | 0.5 | [5]3-5 | .... | .... | .... | .... | 0.3 | .... | .... | .... |
| Big Bend,13-36-66-27 w4m | 35.0 | 6.6 | [19]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Bonnie Glen - Solution, sw 17-47-27 w4m | 68.7 | 49.0 | [7]3-5 | 197.7 | 184.6 | .... | 112.3 | 0.4 | .... | 80.5 | .... |
| *Bonnie Glen - Cycle, sw 17-47-27 w4m | 118.5 | 0.0 | [7]3-5 | .... | 70.9 | .... | 40.7 | .... | .... | 89.0 | .... |
| Boundary Lake South, Floral, 1-14-85-13 w6m | 17.0 | 6.6 | [19]1-3 | .... | .... | .... | .... | .... | 2.2 | .... | .... |
| Castor, 4-3-38-13 w4m | 1.5 | 0.5 | [13]1-6 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Comet Galaxy, Rainbow Lake, 12-23-110-7 w6m | 8.0 | 5.7 | [19]5-3 | .... | .... | .... | .... | .... | .... | 26.9 | .... |
| Countess, 8-36-20-16 w4m | 4.5 | 1.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cynthia, 13-22-49-10 wsm | 8.0 | 3.0 | [19]3-5 | .... | .... | .... | .... | 7.5 | .... | 2.3 | .... |

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| *Devon—1 and 2, 34-50-26 w4m | .... | .... | [illegible] | .... | (138.7) | .... | (69.8) | .... | .... | (69.4) | .... |
| Enchant, Enchant 16-13-13-17w4m | 4.0 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Euerdell, Ferrier 14-20-38-7 w5m | 10.0 | 7.0 | 3-4 | .... | .... | .... | .... | .... | 14.4 | .... | .... |
| Gilby, Gilby, 15-22-40-3 w5m | 51.0 | 20.7 | [illegible]1-2-4 | .... | 17.1 | .... | 11.0 | .... | .... | 13.4 | .... |
| Golden Spike, 16-22-51-27 w4m | 126.0 | 37.2 | 4 | 27.7 | 36.6 | .... | 24.1 | .... | .... | 15.8 | .... |
| Hornbeck, 16-7-54-19 w5 | 20.1 | 5.3 | 3 | .... | .... | .... | .... | .... | 28.4 | .... | .... |
| Irish, 16-36-54-6 w4m | 15.0 | 2.3 | [11]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Joarcam, 11-3-49-21 w4 | 7.6 | 4.2 | 3-4 | .... | .... | .... | .... | .... | 3.4 | .... | .... |
| Joffre D2, Lacombe, ne¼ 17-39-26 w4m | 7.5 | 2.3 | [19]1 3-4 | 4.9 | 3.0 | .... | 2.2 | .... | .... | .... | .... |
| Judy Creek, 10-25-64-11 w5m | 265.0 | 145.5 | 1-2-3<br>4-5-7 | .... |  | .... | .... | .... | 849.7 | .... | .... |
| *Leduc, Devon, 34-50-26 w4m | 35.0 | 38.7 | [19]5-3 | 66.3 | 52.0 | .... | 22.4 | .... | .... | 17.4 | .... |
| Magee, Chigwell, 11-20-42-3 w5m | 7.0 | 4.5 | 3 | .... | .... | .... | .... | 3.8 | .... | .... | .... |
| Medicine Hat-Roseglen, 4-1-16-3 w4m | 20.0 | 5.1 | [11]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Niton, LSD 14-18-54-12 w5m | 50.0 | 24.7 | 3 | .... | .... | .... | .... | .... | 14.2 | .... | .... |
| Open Creek, Wilson Creek— 9&10-34-42-5 w5m | 7.1 | 3.8 | [5]3-5 | .... | .... | .... | .... | 7.9 | .... | .... | .... |
| Quirk Creek, s½ 4-21-4 w5m | 90.0 | 49.0 | 3-5 | .... | 27.7 | .... | 24.1 | .... | .... | 35.4 | .... |
| Redwater, LSD 8 29-57-21 w4m | 22.1 | 4.6 | [19]5-2 | .... | 11.3 | .... | 7.3 | .... | .... | 7.7 | .... |
| Runsey/Rowley, 8-36-33-21 w9m | 10.0 | 5.0 | 3 | .... | .... | .... | .... | .... | 0.4 | .... | .... |
| Sundance, 4-36-54-21 w5 | 15.5 | 11.9 | 3 | .... | .... | .... | .... | .... | 10.7 | .... | .... |
| Swan Hill, 3-18-67-10 w5m | 52.0 | 36.7 | [19]1 | .... | .... | .... | .... | .... | 259.8 | .... | .... |
| Wapiti, 4-8-69-8 w6m | 125.0 | 60.0 | 3-4 | .... | .... | .... | .... | .... | 7.3 | .... | .... |
| Wapiti Deep Cut, 4-8-69-6 w6m | 320.0 | 214.6 | 3-4<br>[21]5-6-7 | 101.0 | .... | .... | .... | .... | 99.8 | .... | .... |
| Willesden Green, 1-17-42-6 w5m | 22.8 | 8.4 | 3 | .... | .... | .... | .... | 11.9 | .... | 4.7 | .... |
| Gulf Canada Corp.— |  |  |  |  |  |  |  |  |  |  |  |
| Baptiste, LSD 5-28-67-22 w5m | 10.4 | 3.9 | [17]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Blood Magrath, 7-8-6-22 w4m | 11.5 | 4.8 | 3 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| Buffalo Lake North, LSD 11-24-41-21 w4m | 7.1 | 1.2 | 3 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Hanna, LSD 2-36-31-14 w4m | 3.0 | 0.6 | 3-4 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Hanlan-Robb, ne¼ 2-49-20 w5m | 304.0 | 169.8 | [8]2 | .... | .... | .... | .... | .... | .... | 5.1 | .... |
| Island Lake, 1-18-68-23 w4m | 5.2 | 1.1 | [23]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Morrin-Ghost Pine, LSD 1, 8-11-31-21 w4m | 109.4 | 54.4 | 3 | .... | .... | .... | .... | .... | .... | 0.4 | .... |
| Nevis, ne¼ 9-33-38-22 w4m | 125.0 | 59.2 | [21-23]2-4 | .... | 67.5 | 51.3 | .... | .... | .... | 45.6 | .... |
| Rimbey, LSD s½ 5-44-1 w5m | 421.0 | 234.4 | [23]2 | .... | 263.8 | 151.7 | .... | .... | .... | 187.2 | .... |
| Strachan, LSD 11-35-37-9 w5m | 275.0 | 146.1 | 7 | .... | .... | .... | .... | .... | 128.1 | 150.3 | .... |
| Swalwell, LSD 6-33-29-24 w5m | 4.0 | 1.0 | 5 | .... | .... | .... | .... | .... | 0.3 | .... | .... |
| West Drumheller, 12-1-30-21 w4m | 3.4 | NR | [23]1 | .... | .... | .... | .... | .... | .... | 1.1 | .... |
| Home Oil Co. Ltd.—Bashaw, 8-10-42-22 w4m | 11.9 | 4.0 | 5 | .... | .... | .... | .... | .... | .... | .... | [11]<0.1 |
| *Carstairs-Crossfield, 3-3-30-2 w5m | 260.0 | 100.0 | 2 | .... | 67.2 | .... | 48.3 | .... | .... | 100.8 | [11]8.0 |
| Cossack, 7-17-60-17 w4m | 6.0 | 0.2 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Leismer, 6, 7-77-7 w4m | 40.0 | 29.5 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Marten Hills South-1, 14-22-74-24 w4m | 21.0 | 9.7 | [13]1-4-[15]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Marten Hills South-2, 14-29-74-25 w4m | 8.0 | 0.8 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Retlaw, 12-2-13-19 w4m | 10.0 | 3.6 | 5 | .... | .... | .... | .... | .... | .... | 0.4 | .... |
| South Elkton, 2-3-31-4 w5m | 8.0 | 4.8 | 3 | .... | .... | .... | .... | .... | .... | 3.0 | .... |
| Tieland, 5-14-67-2 w5m | 10.0 | 3.1 | [13]1-4-[3]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Husky Oil Operations Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Baxter Lake, 11-22-46-5 w4m | 0.6 | 0.4 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Buffalo Coulee, 7-24-46-7 w4m | 4.2 | 4.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cessford, Special Area 3, LSD 4-6-24-10 w4m | 13.5 | 5.7 | 4-[31]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Consort (Provost), 7-34-34-6 w4m | 10.0 | 1.6 | [31]1-3-4 | .... | .... | .... | .... | .... | .... | .... | [11]0.5 |
| Eagle Wildmere, 29-48-6 w4m | 5.7 | 3.4 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Entice, se 24-20-24 w4m | 6.0 | 4.6 | [31]1-4 | .... | .... | .... | .... | .... | .... | .... | [11]0.1 |
| Ghost Pine, 10-4-32-23 w4m | 2.4 | 1.2 | 3-4 | .... | .... | .... | .... | .... | .... | .... | [11]1.5 |
| Halkirk, 2-34-38-16 w4m | 5.0 | 2.1 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]1.8 |
| Killam, 10-27-42-13 w4m | 5.0 | 1.2 | [21]1-4<br>[31]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Kitscoty, 18-50-2 w4m | 0.8 | 0.5 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Kitscoty South, 7-23-49-3 w4m | 2.6 | 2.1 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hussar, 13-36-24-21 w4m | 64.0 | 19.8 | [1]2-4 | .... | 15.4 | .... | 15.8 | .... | .... | .... | [11]7.0 |
| Judy Creek, 8-24-63 I0 w5m | 4.5 | 1.2 | 3-4 | .... | .... | .... | .... | .... | .... | .... | [11]0.3 |
| Leahurst, 15-18-40-18 w4m | 10.0 | 0.7 | [32]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.3 |
| Mannville, 32-52-7 w4m | 3.4 | 2.3 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Nordegg River (Brazeau R), w½ 10-44-12 w5m | 55.0 | 16.0 | [7]1-[32]5 | .... | .... | .... | .... | .... | .... | .... | [11]15.8 |
| North Oyen, 11-17-29 w4m | 4.0 | 1.1 | [31]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| North Wainwright, 16-15-46-6 w4m | 8.5 | 7.0 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Okotoks, MD 31, Foothills, sw¼ 27-20-29 w4m | 34.8 | 30.4 | [21]1-[31]5 | .... | .... | .... | .... | .... | .... | .... | [11]3.8 |
| Rainbow Lake, 10-10-109-8 w6m | 104.0 | 95.7 | [7]1-3-4 | .... | .... | .... | .... | 638.3 | .... | .... | .... |
| Ram River, 2-37-10 w5m | 630.0 | 385.0 | [7]1-[32]5 | .... | .... | .... | .... | .... | .... | .... | [11]32.1 |
| Rivercourse, 8-47-1 w4m | 2.8 | 1.9 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sinclair, 2-14-72-12 w6m | 10.0 | 5.0 | 3 | .... | .... | .... | .... | .... | 5.0 | .... | .... |
| Vermilion South, 5-48-6 w4m | 3.1 | 2.1 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| [illegible]ran (Provost), 15-29-34-8 w4m | 7.0 | 3.4 | [31]1-3-4 | .... | .... | .... | .... | .... | .... | .... | [11]1.3 |
| [illegible]yne Rosedale, 12-4-28-20 w4m | 15.0 | 1.2 | [31]1-3-4 | .... | .... | .... | .... | .... | 1.6 | .... | [11]1.0 |
| Wildmere, 19-47-4 w4m | 2.6 | 1.7 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Wimborne, 16-5-35-26 w4m | 3.8 | 1.0 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| ICG Resources Ltd..— |  |  |  |  |  |  |  |  |  |  |  |
| Acheson, sw¼ 2-53-26 w4m | 7.5 | 7.5 | 3 | .... | 27.0 | .... | 14.0 | .... | .... | 8.6 | .... |
| Chard, 16-1-79-5-w4m | 5.3 | 5.3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cowpor, 11-19-80-4w4m | 12.0 | 7.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Gilby, 10-10-041-03-w5m | 12.0 | 6.0 | [28]5 | .... | .... | .... | .... | .... | 1.7 | .... | .... |
| Hilda, 4-26-17 2 w4m | 5.5 | 2.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Leafland, 13-16-040-05 w4m | 5.5 | 5.5 | 6 | .... | .... | .... | .... | 8.0 | .... | .... | .... |
| Many Islands, 4-16-14-1 w4m | 28.0 | 20.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Tweedie, se½ 19-68-12 w4m | 15.0 | 7.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Jordan Petroleum Ltd.—Three Hills, LSD 11-16-31-23 w4m | 5.0 | 1.5 | 2 | .... | .... | .... | .... | .... | 0.6 | .... | .... |
| Kerr-McGee Corp.— |  |  |  |  |  |  |  |  |  |  |  |
| Craigmyle, 13-5-32-17 w4m | 6.2 | 6.2 | [28]3 | .... | .... | .... | .... | .... | 2.2 | 2.0 | .... |

|  | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Company, plant, location | Gas capacity | Gas throughput | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Elnora, 5-19-35-22 w4m | 18.0 | 15.0 | [3]3 | .... | .... | .... | .... | .... | 4.2 | .... | .... |
| Ferrybank, 3-31-44-27 w4m | 8.5 | 8.5 | [28]3 | .... | .... | .... | .... | .... | .... | 0.5 | .... |
| Rich, 16-22-35-21 w4m | 3.0 | 2.0 | [28]3 | .... | .... | .... | .... | .... | .... | 0.5 | .... |
| Mid-West Gas Transmission Co. Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Fort Saskatchewan, se¼ 3-55-22 w4m | 35.0 | 34.3 | 7 | .... | .... | .... | .... | .... | 63.2 | .... | .... |
| St. Albert, Sturgeon Dist., se¼ 3-26-54-25 w4m | 20.0 | 13.8 | [10]2 | .... | 5.6 | 3.7 | .... | .... | .... | 2.4 | .... |
| Mobil Oil Canada Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Bluesky, Bluesky field, 6-6-109-6w6 | 7.0 | 3.9 | [13]3-5 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Carson Creek, 4 23-61-12 w5m | 70.0 | 60.6 | [19-20]2-4 | .... | 54.5 | .... | 34.7 | .... | .... | 48.1 | .... |
| *Duhamel, 3 32-46-21 w4m | 3.7 | 0.8 | [7]2 | .... | .... | .... | .... | 2.3 | .... | 0.9 | .... |
| Harmattan East, 9-27-31-4w4 | 504.0 | 282.8 | [7-19]2 | .... | 91.5 | .... | 69.4 | .... | .... | 148.9 | .... |
| Liege, 1-16-92-21 w4m | 30.0 | 15.0 | [36]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Lone Pine Creek South, 6-27-29-28 w4m | 35.0 | 12.1 | [7]2 | .... | .... | .... | .... | .... | .... | 7.7 | .... |
| Pembina (Station 4), 16-49-8w5 | 10.4 | 7.7 | 3 | .... | .... | .... | .... | .... | 30.1 | .... | .... |
| Rainbow Battery No. 10, 10-110-6w6 | 33.0 | 23.8 | [13]5-3 | .... | .... | .... | .... | .... | 143.6 | .... | .... |
| Teepee Creek, Grande Prairie, LSD 7-2-74-4 w6m | 18.5 | 6.0 | [7]2 | .... | .... | .... | .... | .... | .... | 1.7 | .... |
| Three Hills, 4 33-31-23 w4m | 30.0 | 16.4 | 3-4 | .... | .... | .... | .... | 13.1 | ... | 4.5 | .... |
| Willesden Green, 8 29-40-6-5 w5m | 2.0 | 1.7 | 3-4 | .... | .... | .... | .... | 2.1 | .... | .... | .... |
| Wimborne, 4 12-34-26 w4h | 30.0 | 20.6 | 3-4 | .... | .... | .... | .... | .... | .... | 6.7 | .... |
| Wintering Hills, 16 7-24-16 w4h | 6.0 | 0.8 | 3-4 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Murphy Oil Co. Ltd.—Glendon, Sugden-Grand Rapids, 03-16-61-8 w4m | 11.0 | 0.8 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Princess No. 1, 14-23-19-10 w4m | 7.5 | 4.0 | [13]4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Princess No. 2, 08-16-20-10 w4m | 7.5 | 4.0 | [13]4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Norcen Energy Resources Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Bigoray, Parkland 31, 10-22-51-8 w5m | 3.0 | 1.3 | 3-4 | .... | .... | .... | .... | .... | 15.7 | .... | .... |
| Boyer, 1-17-105 1 w6m | 18.0 | 13.0 | 4-[8]5 | .... | .... | .... | .... | .... | 137.1 | .... | .... |
| Bruce, Beaver 9, 2-6-47-15 w4m | 30.0 | 5.5 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ferrier, Radial Lake, se¼ 2-34-40-9 w5m | 20.6 | 6.8 | 3 | .... | .... | .... | .... | .... | 238.0 | .... | .... |
| Gilby, Lacombe, 10-8-41-1 w5m | 2.6 | 1.3 | [13]2-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Judy Creek, 12-19-64-1 w5m | 2.0 | 1.0 | 1-[8]5 | .... | .... | .... | .... | .... | .... | 340.0 | .... |
| Kessler, 14-5-39-8 w4m | 5.6 | 1.7 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| McLeod 16-17-55 14 w5m | 3.2 | 2.0 | 3-4 | .... | .... | .... | .... | .... | 35.0 | .... | .... |
| McLeod River, Dist. 14, 7-34-54-14 w5m | 5.2 | 3.3 | 3-4 | .... | .... | .... | .... | .... | 96.0 | .... | .... |
| Minnehik-Buck Lake, 10-5-46-6 w5m | 108.0 | 70.0 | [7]1<br>[32]5-7 | .... | .... | .... | .... | .... | 43.4 | 32.6 | .... |
| Netook-Olds, Mountain View 17, 16-21-33-1 w5m | 1.9 | 1.6 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Provost-Bodo, Provost 52, ne¼ 16-31-37-2 w4m | 5.0 | 1.0 | [13]1-3-4 | .... | .... | .... | .... | .... | .... | 100.0 | .... |
| Spirit River, 8-34-77 6 w6m | 4.0 | 3.1 | 3 | .... | .... | .... | .... | .... | 6.7 | .... | .... |
| North Canadian Oils Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Atlee Buffalo, 5-22-20-4 w4m | 4.0 | 3.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bantry, 5-8-19-13 w4m | 18.0 | 12.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Beaverhill Lake, 4-17-52-18 w4m | 3.0 | 2.5 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bellshill Lake, 7-21-42-12 w4m | 4.0 | 3.5 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Buffalo South, 4-22-20-5 w4m | 4.0 | 3.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Canard, 9-30-57-8 w4m | 12.0 | 12.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Conlac, Medicine Hat, 14-14-14-3 w4m | 25.0 | 12.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Corbett Creek, 13-26-61-8 w5m | 12.0 | 0.5 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Delia, 1-13-32-19 w4m | 25.0 | 23.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Dinant, Bruce, 1-26-45-19 w4m | 20.0 | 20.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Fenn Big Valley, 8-27-35-19 w4m | 8.0 | 7.0 | 3-4 | .... | .... | .... | 3.0 | .... | .... | .... | .... |
| Garden-Plains, 5-15-33-13 w4m | 10.0 | 3.5 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hilda, Medicine Hat, 9-34-18-2 w4m | 7.0 | 3.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hilda Schuler, 13-9-17-1 w4m | 5.0 | 3.4 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hilda West, 4-19-18-1 w4m | 3.5 | 2.7 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Jarrow, 8-15-45-11 w4m | 4.0 | 3.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Knopcik, 9-10-74-11 w6m | 25.0 | 20.0 | 3-4 | .... | .... | .... | .... | .... | 7.0 | .... | .... |
| Minburn, 8-24-51-10 w4m | 7.0 | 7.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Morinville, 11-15-55-25 w4m | 2.5 | 1.4 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| North Mannville, 13-16-53-10 w4m | 7.0 | 6.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| North Plain Lake, 13-31-54-11 w4m | 14.0 | 14.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Schuler, 1-28-16-1 w4m | 3.5 | 2.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sedgewick, 4-27-44-10 w4m | 3.0 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Simonette, 7-6-63-26 w5m | 2.0 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sugden, 11-11-65-9 w4m | 2.0 | 2.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Vale, Medicine Hat, 15-19-14-3 w4m | 30.0 | 15.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Viking-Kinsella, 11-17-46-8 w4m | 15.0 | 10.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Warwick, 8-34-52-14 w4m | 4.0 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| West Basset Lake, 7-14-108-7 w6m | 6.0 | 0.5 | 3-4 | .... | .... | .... | .... | .... | 1.5 | .... | .... |
| Westlock, 13-24-61-26 w4m | 9.0 | 6.5 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Willingdon, 11-20-55-15 w4m | 18.0 | 10.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| NSM Resources Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Choice, 5 27-40-10 w4m | 3.0 | 3.0 | [3]2 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Redwater, Lamont, 15-16-56-20 w4m | 1.0 | 0.1 | 3 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Oakwood Petroleums Ltd.—Oakwood Grand Forks, 8-7-12-13 w4m | 3.0 | 1.0 | [7]2-4 | .... | .... | .... | .... | 4.0 | .... | .... | .... |
| Palmer Ranch (1984) Ltd.—Pincher Creek, s½ 23-4-29 w4m | 12.0 | 6.0 | 3-4 | 1.0 | .... | .... | .... | .... | .... | 4.5 | .... |
| Paloma Petroleum Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Berry, 16-21-28-13 w4m | 9.0 | 8.0 | 3-4 | .... | .... | .... | .... | .... | .... | .... | [11]0.1 |
| Compeer, 4-31-33 1 w4m | 12.0 | 12.5 | 2-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hotchkiss, LSD 7 13-94-3 w6m | 6.0 | 2.5 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Kinsella, 12-36-49 13 w4m | 5.0 | 3.5 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Lavory, 6-13-52-14 w4m | 8.5 | 7.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Nestou, 11-23-60-24 w4m | 4.5 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Snoky Lake, 7-9-59-17 w4m | 2.5 | .... | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Viking, LSD 12 36-49-13 w4m | 4.5 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| PanCanadian Petroleum Ltd.—Alderson West, 10-28-15-15 w4m | 23.5 | 3.1 | 3 | .... | .... | .... | .... | .... | .... | 12.9 | [11]<0.1 |
| Alderson West, 6-2-16-15 w4m | 6.0 | 1.9 | [3]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bassano Lathom, 10-5-22-18 w4m | 25.0 | 5.1 | [31]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.7 |

| Company, plant, location | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| Carseland, 16-21-22-25 w4m | 12.0 | 7.6 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]<0.1 |
| Countess 10-20-18-15 w4m | 8.0 | 3.4 | [7]2 | .... | .... | .... | .... | 3.4 | .... | .... | [11]2.5 |
| Countess Makepeace, 12-33-22-18 w4m | 30.0 | 9.5 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]2.0 |
| Entice, 10-7-28-23 w4m | 7.0 | 1.6 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]<0.1 |
| Ferrybank, 2-1-44-28 w4m | 26.0 | 8.4 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]4.5 |
| Gilby Cantex Nortun, 6-21-40-2 w5m | 2.1 | 0.8 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]0.4 |
| Halkirk, 03-36-37-17 w4m | 3.0 | 0.9 | 3 | .... | .... | .... | .... | .... | .... | ¶3.7 | .... |
| Hussar Crowfoot, 14-1-24-22 w4m | 28.0 | 6.8 | 3 | .... | .... | .... | .... | 1.7 | .... | .... | [11]2.1 |
| Long Coulee, 6-30-15-21 w4m | 8.2 | 3.5 | [7]2 | .... | .... | .... | .... | .... | .... | .... | [11]0.8 |
| Redland, 1-20-28-21 w4m | 20.0 | 9.0 | 3 | .... | 1.0 | .... | 1.5 | .... | .... | .... | [11]2.8 |
| Rycroft, 8-25-77-06 w6m | 4.0 | 1.2 | [7]2 | .... | .... | .... | .... | .... | .... | ¶2.1 | .... |
| Tide Lake, 16-10-18-10 w4m | 10.0 | 6.9 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Wayne Dalum, 5-17-27-19 w4m | 19.0 | 3.4 | [31]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.6 |
| Wintering Hills, 1-18-25-17 w4m | 20.0 | 2.3 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]0.8 |
| Pembina Resources Ltd..— | | | | | | | | | | | |
| Breton, LSD 9-36-47-4 w5m | 3.5 | 1.5 | 3 | .... | .... | .... | .... | 2.2 | .... | .... | .... |
| Compeer, 6-36-33 2 w4m | 5.0 | 1.8 | [28]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Diamond Valley, 10-12-19-2 w5m | 20.0 | 17.3 | 7 | 40.9 | 28.0 | .... | 16.7 | .... | .... | 15.9 | .... |
| Hotchkiss, North, LSD 3 35-94-2 w6m | 16.0 | 7.7 | [34]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Petro-Canada Inc — | | | | | | | | | | | |
| Bellshill, Lake 3 28-41-12 w4m | 3.0 | 2.8 | [7]2 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Brazeau River, 4-31-48-12 w5m | 75.1 | 23.3 | [7]2 | .... | .... | .... | .... | .... | .... | 164.6 | .... |
| *Brazeau River, sw¼ 31-48-12 w5m | 37.3 | 32.0 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Connorsville, 9 32-25-15 w4m | 30.0 | 11.6 | 3-4 | .... | .... | .... | .... | .... | .... | 2.3 | [11]114.1 |
| Empress, ne-11-20-01-4 | 2,400.0 | 2,400.0 | 6 | 1,320.9 | 528.4 | 79.3 | 100.4 | .... | .... | 79.3 | .... |
| Ferrier, 9 22-39-8 w5m | 8.0 | 4.5 | 3-4 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| Gilby No. 1064, Fina, 7 27-40-3 w5m | 4.2 | 1.2 | 6 | .... | .... | .... | .... | .... | .... | 174.9 | .... |
| Gilby No. 1130, 2 27-40-3 w5m | 25.0 | 11.1 | [7]2 | .... | .... | .... | .... | 2.2 | .... | .... | .... |
| Gilby No. 1156, Medicine River, 5-5-40-3 w5m | 28.0 | 14.7 | [7]2 | .... | .... | .... | .... | 16.1 | .... | 2.8 | .... |
| Gold Creek, nw¼ 26-67-5 w6m | 36.5 | 8.4 | [7]2-4 | .... | .... | .... | .... | .... | .... | 21.0 | .... |
| Greencourt, 9 26-59-9 w5m | 37.0 | 11.1 | [7]1-4-[31]5 | .... | .... | .... | .... | .... | .... | 2.7 | .... |
| *Kaybob North, 8 9-64-19 w5m | 131.0 | 85.7 | [7]1-3-4 | .... | .... | .... | .... | .... | 48.0 | 14.8 | .... |
| Rainbow, 15 7-108-6 w6m | 14.3 | 7.8 | 3-4 | .... | .... | .... | .... | .... | .... | 0.3 | .... |
| Sedgewick, 2 16-42-12 w4m | 6.0 | 1.6 | [21]2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Valhalla Halfway, se¼ 12-75-9 w6m | 4.2 | 1.3 | [13]1-3-4 | .... | .... | .... | .... | .... | 3.2 | .... | .... |
| Wildcat Hills, 6 16-26-5 w5m | 110.0 | 51.7 | [21]1-4-[8]5 | .... | .... | .... | .... | .... | .... | 13.9 | .... |
| Phillips Petroleum Resources Ltd.—Gilby, LSD 6-36-40-3 w5m | 2.7 | 1.5 | 6 | .... | .... | .... | .... | .... | .... | 0.7 | .... |
| Sylvan Lake, 13-25-37-2 w5m | 29.8 | 18.5 | 3 | .... | .... | .... | .... | .... | 24.2 | <0.1 | .... |
| Placer Cego Petroleum Ltd.— | | | | | | | | | | | |
| Atlee, 09-13-21-01 w4m | 2.5 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bindloss, South, 11-20-23-03 w4m | 17.5 | 14.0 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Bindloss, North, 11-27-23-04 w4m | 17.3 | 14.0 | 1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hilda, 13-22-17-03 w4m | 15.0 | 8.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Medicine Lodge, 9-9-52-21 w5m | 14.5 | 12.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Provost, 4-16-33-07 w4m | 5.0 | 1.5 | [26]2-4 | .... | .... | .... | .... | .... | .... | .... | [11]0.1 |
| Sedalia, 9-29-31-05 w4m | 10.0 | 6.8 | 4-[32]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.1 |
| Steveville, 2-31-22-11 w4m | 20.0 | 4.0 | [32]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.2 |
| Wood River, 16-08-45 23 w4m | 5.0 | 2.0 | 1-4-[32]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.2 |
| Saratoga Processing Co. Ltd.—Coleman, 11-8-5 w5m | 35.0 | 31.0 | [21]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sceptre Resources Ltd.— | | | | | | | | | | | |
| Cessford, 7-17-26-14 w4m | 7.5 | 1.7 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]0.3 |
| Holmberg, nw¼ 13 14-44-17 w4m | 11.5 | 8.8 | [33]2 | .... | .... | .... | .... | .... | .... | .... | [11]0.3 |
| Huxley, 6-17-34-24 w4m | 12.5 | 4.1 | [32]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.9 |
| Judy Creek, 1-21-63-11 w5m | 3.0 | 0.3 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]<0.1 |
| Sorenson, 16-09-32-12 w4m | 10.0 | 10.0 | 3-4 | .... | .... | .... | .... | 7.9 | .... | .... | [11]0.5 |
| Stanmore, 5-1-29-12 w4m | 30.0 | 10.6 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]1.5 |
| Shell Canada Ltd.— | | | | | | | | | | | |
| Bonanza, 8-80-12 w6m | 4.7 | 4.5 | [13]1-6 | .... | .... | .... | .... | .... | .... | 3.4 | .... |
| Burnt Timber 1 and 2, 13-30-7 w5m | 127.0 | 91.8 | [33]1-3 | .... | .... | .... | .... | .... | .... | 7.0 | .... |
| Cranberry Lower Debolt, 4-20-96-3 w6m | 14.0 | 9.1 | [29]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cranberry Slave Point, 4-20-96-3 w6m | 17.0 | 14.0 | 3-4 | .... | .... | .... | .... | .... | 13.4 | 16.7 | .... |
| Gordondale, 24-79-11 w5m | 9.3 | 2.8 | [13]1-6 | .... | .... | .... | .... | .... | .... | 3.7 | .... |
| *Hamburg, 12-29-96-11 w6m | 65.3 | 35.0 | [31]5 | .... | .... | .... | .... | .... | .... | 5.5 | .... |
| Hope Creek, 17-64-13 w5m | 5.4 | 3.5 | [29]1-3 | .... | .... | .... | .... | .... | .... | 5.3 | .... |
| House Mountain, 8-70-10 w5m | 9.2 | 2.7 | [29]1-3 | .... | .... | .... | .... | .... | 25.0 | .... | .... |
| Jumping Pound, nw¼ 13-25-5-w5m, se¼ 23-25-5 w5m, sw¼ 24-25-5 w5m | 200.0 | 158.0 | [29]1-2-7 | 112.5 | 38.5 | .... | 33.8 | .... | .... | 102.9 | .... |
| Pouce Coupe, 8-80-12 w6m | 3.3 | 0.8 | [11]1-6 | .... | .... | .... | .... | .... | .... | 1.1 | .... |
| Progress, 1-78-10 w6m | 45.0 | 38.7 | [13]2-4 | .... | .... | .... | .... | 26.4 | .... | 29.0 | .... |
| Simonette, 6-63-25 w5m | 21.7 | 16.3 | [29]1-3 | .... | .... | .... | .... | 15.8 | .... | 9.2 | .... |
| South Rosevear, ne 11-54-15 w5m | 50.0 | 21.1 | [20]1-3 | .... | .... | .... | .... | .... | .... | 6.8 | .... |
| Waterton 1-2 and Straddle s½ 20-4-30 w4m, n½ 17-4-30 w4m, se¼ 24-4-1-w5m | 315.0 | 151.8 | [29]1-3-7 | 199.0 | 85.9 | .... | 71.7 | .... | .... | 200.8 | .... |
| Star Oil & Gas Ltd.— | | | | | | | | | | | |
| Grassland, 6-13-68-18 w4m | 2.0 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pouce Coupe, 11-34-79-12 w6m | 10.0 | 6.0 | 3 | .... | .... | .... | .... | 4.0 | .... | .... | .... |
| Redwater, 8-25-57-23 w4m | 6.2 | 3.0 | 2-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sunnybrook, Bell River Pool 15-22-48-2 w5m | 5.0 | 2.5 | 3-4 | .... | .... | .... | .... | .... | 0.5 | .... | .... |
| Sylvan Lake, Basal Quartz, Glauc., 16-19-38-1 w5m | 8.0 | 6.0 | [13]1-3-4 | .... | .... | .... | .... | 5.9 | .... | .... | .... |
| Steen Resources Ltd.—Crossfield, 8-20-30-3 w5m | 4.0 | 3.0 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]4.2 |
| Suncor Inc.— | | | | | | | | | | | |
| Joffre, LSD 13-12-38-12 w4m | 6.4 | 3.8 | 3 | .... | .... | .... | .... | 5.0 | .... | .... | .... |
| Pine Creek, 10-23-57-19 w5m | 13.5 | 8.8 | 3 | .... | .... | .... | .... | .... | 19.3 | .... | .... |
| Rosevear, ne¼ 16-33-54-15 w5m | 30.0 | 18.4 | [7]1-[8]5 | .... | .... | .... | .... | .... | .... | .... | [11]6.5 |
| Thorsby, 4-27-49-1 w5m | 14.5 | 9.3 | 3 | .... | .... | .... | .... | .... | 10.5 | .... | .... |
| Texaco-Canada Resources— | | | | | | | | | | | |
| Battle Lake, 23-46-2 w5m | 5.5 | 0.3 | 3 | .... | .... | .... | .... | <0.1 | .... | .... | .... |
| *Bonnie Glen Cycle, 17-47-27 w4m | 140.0 | 110.3 | 7 | .... | 76.3 | 11.2 | 27.4 | .... | .... | 73.5 | .... |
| Bonnie Glen Gas No. 1, 17-47-27 w4m | 50.0 | 30.1 | [19]2 | .... | 20.8 | .... | 23.2 | .... | .... | 19.7 | .... |

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas through-put | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bonnie Glen Gas No. 2, 17-47-27 w4m | 50.0 | 36.4 | 3 | 196.9 | 124.6 | 20.5 | 44.6 | .... | .... | 46.6 | .... |
| Cynthia, 13 22-49-10 w5m | 10.5 | 3.7 | 3 | .... | .... | .... | .... | 9.9 | .... | 2.4 | .... |
| Gilby, 15-22-40-3 w5m | 58.0 | 4.5 | [19]1 | .... | 3.4 | .... | 3.0 | .... | .... | 3.4 | .... |
| Magee, 11-20-42-25 w4m | 7.0 | 4.2 | 3 | .... | .... | .... | .... | 4.3 | .... | .... | .... |
| Open Creek 10-34-42-5 w5m | 8.0 | 4.9 | 3 | .... | .... | .... | .... | 7.7 | .... | .... | .... |
| Wabasca, 16-36-80-25 w4m | 6.0 | 4.2 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Willesden Green, 17-42-6 w5m | 12.2 | 4.6 | 3 | .... | .... | .... | .... | 3.9 | .... | 2.1 | .... |
| Total Petroleum Canada Ltd.— | | | | | | | | | | | |
| Gilby, 10 12-41-3 w5m | 8.0 | 6.0 | [7]1-4-[32]5 | .... | .... | .... | .... | .... | .... | .... | [11]0.9 |
| Hythe, 16-21-73-10 w6m | 8.5 | 8.0 | 3-4 | .... | .... | .... | .... | 5.5 | .... | .... | [11]3.9 |
| Sutton 7 21-90-4 w6m | 3.0 | 1.3 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ulster Petroleums Ltd.— | | | | | | | | | | | |
| Huxley, 7-17-35-24 w4m | 3.0 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Irvine, Medicine Hat, 1-23-12-2 w4m | 3.5 | 1.0 | 4 | .... | .... | .... | .... | .... | 2.6 | .... | .... |
| Rumsey, 8-12-34-21 w4m | 5.0 | 4.0 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Wainwright East GGS, 11-34-44-6 w4m | 4.0 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Union Pacific Resources Inc.— | | | | | | | | | | | |
| Baptiste Lake, 14-34-65-24 w4m | 22.0 | 6.0 | [7]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Cynthia Pembina, 9-16-51-11 w5m | 1.2 | 1.0 | 3 | .... | .... | .... | .... | .... | 1.8 | .... | .... |
| Westcoast Energy Inc.—Ferrier Cardium 2, LSD 1-20-39-7 w5m | 23.0 | 9.9 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **22,630.2** | **14,033.4** | | **6,419.9** | **3,248.3** | **870.4** | **814.2** | **1,214.8** | **4,160.0** | **4,123.1** | **671.4** |

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†Fractionation. (Figures in parenthesis do not represent primary production, and are not added in state totals). §And condensate. ¶$C_3$+

## British Columbia

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Canada Petroleum Co. Ltd.— | | | | | | | | | | | |
| Alces, 8-34-83-15 w6m | 15.9 | 5.5 | 1-6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Buick Creek North, 6-31 e-94 A-14 | 8.0 | 0.2 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Dahl, a-89 H-94 H-7 | 8.0 | 2.6 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Laprise, a-40 e-94 H-5 | 20.0 | 12.9 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Velma, a-89 D-94 H-8 | 14.0 | 6.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Esso Resources Canada Ltd.—Boundary Lake, 1-2-85-14 w6 | 17.5 | 1.9 | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Mobil Oil Canada Ltd.—Sierra, c-91-D 94-I-14 | 310.0 | 225.2 | [32]5-3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Norcen Energy Resources Ltd.— | | | | | | | | | | | |
| *Jedney, A-62-E/94-G-8 | 12.0 | 8.0 | 4-[31]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Placer CEGO Petroelum— | | | | | | | | | | | |
| Boundary Lake, 11-24-84-15 w6m | 21.0 | 20.0 | 6 | .... | .... | .... | .... | 3.5 | .... | .... | .... |
| Westcoast Energy Inc.— | | | | | | | | | | | |
| Boundary Lake, A-10-25 15 w6m | 8.9 | 3.2 | [2]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Fort Nelson, Lot 2683, Peace River | 750.0 | 447.0 | [2&5&12]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pine River, Lot 1156, Peace River | 140.0 | 56.0 | [29]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sikanni, Lot 3472, Peace River | 70.0 | 68.0 | [2]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Taylor, 2 36-82-18 w4m Peace River Dist., Plan 7891 | 385.0 | NR | 7 | .... | 192.5 | .... | 65.9 | .... | .... | 31.0 | .... |
| **Total** | **1,780.3** | **856.5** | | .... | **192.5** | .... | **65.9** | **3.5** | .... | **31.0** | .... |

## Northwest Territories

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Canada Petroleum Co. Inc.— | | | | | | | | | | | |
| Pointed Mountain, 95-85-n24 | 188.0 | 15.8 | [13]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Esso Resources Canada Ltd.—Norman Wells | 31.9 | 12.5 | 5 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **219.9** | **28.3** | | .... | .... | .... | .... | .... | .... | .... | .... |

## Saskatchewan

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Canada Petroleum Co. Ltd.— | | | | | | | | | | | |
| Steelman, w½-21-4-5 w2m | 18.5 | 13.9 | [7]1-3-4<br>[23]5-7 | ... | .... | .... | .... | .... | 104.2 | .... | ..... |
| Anderson Exploration Ltd.— | | | | | | | | | | | |
| Greenan, 11-12-16-16 w3m | 2.0 | 1.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Husky Oil Operations Ltd.— | | | | | | | | | | | |
| Hillmond, 35-51-26 w3m | 7.5 | 6.2 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Macklin, 7-18-37-28 w3m | 2.0 | 1.5 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Tangleflags, 25-50-25 w3m | 7.4 | 4.6 | [35]1-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| ICG Resources Ltd.— | | | | | | | | | | | |
| Hatton, 4-15-14-27 w3m | 9.0 | 8.0 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Totnes, 15-33-027-18 w3m | 2.5 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Mobil Oil Canada Ltd.—Gull Lake, 5-9-14-19 w3h | 1.9 | 1.1 | [32]5-3 | .... | .... | .... | .... | .... | .... | 0.4 | .... |
| North Canadian Oils Ltd.— | | | | | | | | | | | |
| Enterprise, 11-15-28 w3m | 25.0 | 18.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Golden Prairie, 11-36-14-29 w3m | 12.0 | 11.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hatton, 6-28-14-29 w3m | 22.0 | 20.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hatton East, 4-21-14-28 w3m | 15.0 | 13.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Horsham, 18-16-29 w3m | 7.5 | 6.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Inglenook, 13-8-28-23 w3m | 3.0 | 3.0 | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| McLaren Lake, 35-15-29 w3m | 1.5 | 1.5 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Richmound, Hatton, 1-4-16-29 w3m | 20.0 | 18.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sandhills, 34-13-25 w3m | 15.0 | 13.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sask Energy Corp., TransGas Div.— | | | | | | | | | | | |
| Coleville, nw 17-31-23 w3m | 40.0 | 34.0 | 1-2 | .... | .... | .... | .... | 12.9 | .... | .... | [11]15.5 |
| Hoosier, se 16-30-28 w3m | 3.0 | 1.0 | [31]5 | .... | .... | .... | .... | .... | .... | .... | [11]2.5 |
| Success, 17-16-17 w3m | 50.0 | .... | [31]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Star Oil & Gas Ltd.—Bigstick, 5-11-14-26 w3m | 10.0 | .... | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hatton 3, LSD 4—4-15-14-27 w3m | 8.0 | 8.0 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Hatton East, 16-19-13-26 w3m | 9.6 | 9.6 | 4 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **295.4** | **194.3** | | .... | .... | .... | .... | **12.9** | **104.7** | **0.3** | **18.0** |

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/ condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CHILE** | | | | | | | | | | | |
| Empresa Nacional del Petroleo—*Cullen, Magallanes, Primavera | 150.0 | 113.0 | [19]1 | .... | 52.0 | .... | 37.0 | .... | .... | 27.0 | .... |
| Posesión-*Cabo Negro, Magallanes, San Gregorio | 320.0 | 310.0 | 7 | .... | 138.0 | .... | 83.0 | .... | .... | 79.0 | .... |
| **Total** | **470.0** | **423.0** | | .... | **190.0** | .... | **120.0** | .... | .... | **106.0** | .... |
| **CHINA, TAIWAN** | | | | | | | | | | | |
| Chinese Petroleum Corp.—Chingtsachu plant and field, Hsin Chu area | 60.0 | 14.5 | 7 | .... | .... | .... | .... | .... | 8.7 | .... | .... |
| Chinshui plant, field, and area | 35.3 | NR | 1 | .... | 5.3 | .... | 6.2 | .... | .... | .... | [11]3.5 |
| Chuhuangkeng plant, field, and area | 75.0 | 45.7 | [14]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Tunghsiao plant, Tieh-Che-Shan field, Tunghsiao area | 100.0 | NR | 7 | 13.2 | 21.1 | 0.8 | 10.6 | .... | .... | .... | [11]8.8 |
| **Total** | **270.3** | **60.3** | | **13.2** | **26.4** | **0.8** | **16.8** | .... | **8.7** | .... | **12.3** |
| **COLOMBIA** | | | | | | | | | | | |
| Empresa Colombiana de Petroleos—Barrancabermeja, Santander | 100.0 | 83.0 | 7 | 132.8 | .... | .... | .... | 23.0 | .... | .... | .... |
| Cicuco, Bolivar | 40.0 | 12.0 | 3 | .... | .... | .... | .... | 3.2 | .... | 2.8 | .... |
| El Dificil, Magdalena | 25.0 | 13.0 | 1 | .... | .... | .... | .... | 7.3 | .... | 7.6 | [3]0.3<br>[4]0.8 |
| La Cira, El Centro, Santander | 48.0 | 28.0 | [16]2 | .... | 18.0 | .... | 19.5 | .... | .... | 27.0 | .... |
| Tibu, Norte Santander | 62.0 | 9.0 | 3 | .... | .... | .... | .... | 10.0 | .... | 6.3 | .... |
| Esso Colombiana Ltd.—Provincia, Santander | 73.0 | 73.0 | [36]1-[26]2 | .... | 34.0 | .... | 39.0 | .... | .... | 27.0 | .... |
| **Total** | **348.0** | **218.0** | | **132.8** | **52.0** | .... | **58.5** | **43.5** | .... | **70.7** | **1.1** |
| **DENMARK** | | | | | | | | | | | |
| Dansk Naturgas A/S—Nybro, Ribe Amt Jutland | **450.0** | **240.0** | [33,35]1-3-6 | .... | .... | .... | .... | .... | .... | .... | **[11]100.0** |
| **DOMINICAN REPUBLIC** | | | | | | | | | | | |
| Falconbridge Dominicana C × A—*Bonao field, Arzo-Nouel Province, LaVega, La Peguera | NR | NR | .... | .... | .... | .... | .... | .... | .... | .... | [6]88.2<br>[10]189.0 |
| **Total** | .... | .... | | .... | .... | .... | .... | .... | .... | .... | **277.2** |
| **DUBAI** | | | | | | | | | | | |
| ARCO Oil & Gas Co.—Marghan | **330.0** | **330.0** | 6 | .... | .... | .... | .... | .... | .... | .... | **[11]650.5** |
| **ECUADOR** | | | | | | | | | | | |
| CEPE—Ancon, Santa Elena field, Guayas | 16.0 | 5.5 | [1]1 | .... | .... | .... | .... | 1.1 | .... | 5.6 | .... |
| Shushufindi, Napo Province | 25.0 | 15.0 | 3 | .... | .... | .... | .... | 96.0 | .... | 31.7 | .... |
| **Total** | **41.0** | **20.5** | | .... | .... | .... | .... | **97.1** | .... | **37.3** | .... |
| **EGYPT** | | | | | | | | | | | |
| Amoco Egypt Oil Co.—Abu Gharadig/ Dahshour, Abu Gharadig field, Western Desert, Block 30 | 125.0 | 101.0 | 7-8 | .... | .... | .... | .... | 103.3 | .... | .... | [11]84.9 |
| Egyptian General Petroleum Corp.—Abu Gharadig field, 286 km west of Cairo, Western Desert | 132.0 | 124.0 | [23]5-7 | .... | .... | .... | .... | .... | .... | .... | [11]210.0 |
| Abu Madi LTS plant and field, K. Sheikh | 242.0 | 236.0 | [35]1-6 | .... | .... | .... | .... | .... | .... | .... | [11]203.3 |
| Abu Madi LPG plant and field, K. Sheikh | 236.0 | 225.0 | [23]5-7 | .... | .... | .... | .... | 60.4 | .... | .... | [11]215.0 |
| Abu Qir plant and field offshore, 60 km east of Alexandria | 206.0 | 198.0 | [23]5-7 | .... | .... | .... | .... | 48.8 | .... | .... | [11]206.2 |
| Dahshour, Abu Gharadig field, 65 km west of Cairo, Giza | 124.0 | 118.0 | 7 | .... | .... | .... | .... | 132.0 | .... | .... | .... |
| Ras-Shukeir | 177.0 | 131.0 | [23]3-5-7 | .... | .... | .... | .... | 283.2 | .... | .... | [11]190.7 |
| Zeit Bay | 78.0 | 55.0 | [35]1-3 | .... | .... | .... | .... | 64.0 | .... | .... | [11]48.4 |
| **Total** | **1,320.0** | **1,188.0** | | .... | .... | .... | .... | **691.7** | .... | .... | **1,158.5** |
| **FRANCE** | | | | | | | | | | | |
| SNEA—Usine de Lacq | **570.0** | **563.0** | 1 | .... | **139.0** | .... | **132.0** | .... | .... | **270.0** | .... |
| **GERMANY** | | | | | | | | | | | |
| Mobil Oil AG— | | | | | | | | | | | |
| Norddeutsche Erdgas Aufbereitungs GmbH, Scholen Concession, Lower Saxony, Sulingen Province (50% MoAG) | 307.0 | 223.0 | [27-29-33]1 | | | | | | | | |
| Wintershall AG—Emlishheim, Lower Sacony | 27.0 | 17.0 | [1]1 | (sulfur recovery only) | | | | | | | |
| Ruetenbrock, Ruetenbrock-Fehndorf, Haren, Lower Saxony | 32.0 | 34.0 | [29]1 | (sulfur recovery only) | | | | | | | |
| **Total** | **366.0** | **274.0** | | | | | | | | | |
| **GREECE** | | | | | | | | | | | |
| North Aegean Petroleum Co.—Gas sweetening plant, Prinos and South Kavala field | 27.0 | NR | 1 | .... | .... | .... | .... | .... | 72.0 | .... | .... |
| NGL plant, Prinos and South Kavala field | 12.0 | NR | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **39.0** | **31.2** | | .... | .... | .... | .... | .... | **72.0** | .... | .... |

| Company, plant, location | MMcfd |  |  | Production—1,000 gpd (Average based on the past 12 months) |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gas capacity | Gas throughput | Process/condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |

## HUNGARY

| Company, plant, location | Gas capacity | Gas throughput | Process/condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OKGT: |  |  |  |  |  |  |  |  |  |  |  |
| Babócsa plant and field, Somogy | 24.7 | NR | 6 | .... | .... | .... | .... | .... | .... | .... | [11]2.8 |
| Berekfürdő, Tatárülés-Kunmadaras, Szolnok | 28.3 | 5.2 | 6 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Demjén plant and field, Heves | 5.1 | 1.8 | 5 | .... | .... | .... | .... | .... | .... | .... | [11]0.2 |
| Ebes plant and field, Hajdu-Bihar | 8.5 | 3.0 | 6 | .... | .... | .... | .... | .... | .... | .... | [11]0.3 |
| Endrőd plant and field, Bekes | 70.0 | 38.6 | 6 | .... | .... | .... | .... | .... | 46.6 | .... | .... |
| Hajduszoboszló plant and field, Hajdu-Bihar | 77.7 | 25.0 | [1]2 | .... | .... | .... | 1.2 | .... | .... | 30.2 | .... |
| Kardoskút plant, Pusztaföldvár field, Békés | 42.4 | 28.5 | 3 | .... | .... | .... | .... | .... | .... | 35.1 | .... |
| Kiskunhalas plant and field, Bács-Kiskun | 8.5 | 0.9 | 6 | .... | .... | .... | .... | .... | .... | .... | [11]0.5 |
| Szank plant and field, Bács-Kiskun | 77.7 | 52.9 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]11.9 |
| Szeged plant, Algyő field, Csongrád | 566.0 | 245.0 | [1]2-3-6 | .... | 65.7 | 6.3 | 68.8 | .... | 179.2 | 753.9 | [1]40.6<br>[8]44.0 |
| Tázlár plant and field, Bács-Kiskun | 28.3 | 3.9 | 6 | .... | .... | .... | .... | .... | .... | .... | [11]3.3 |
| Üllés plant and field, Csongrád | 160.0 | 70.5 | 6 | .... | .... | .... | .... | .... | 141.6 | .... | .... |
| **Total** | **1,097.2** | **475.3** |  | **....** | **65.7** | **6.3** | **70.0** | **....** | **367.4** | **819.2** | **103.6** |

## INDONESIA

| Company, plant, location | Gas capacity | Gas throughput | Process/condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic Richfield Indonesia Inc.—Ardjuna, nw Java Sea, 90 miles ne of Jakarta | 180.0 | 60.0 | 7 | .... | 201.6 | †113.4 | .... | .... | .... | .... | .... |
| P.T. Badak NGL Co., Bantang | 1,000.0 | 1,000.0 | 7 | .... | .... | .... | .... | .... | 1,200.0 | .... | .... |
| Pertamina Arun Natural Gas Liquefaction Co.— |  |  |  |  |  |  |  |  |  |  |  |
| *Pertamina Arun, Aceh Utara, Aceh | 2,270.0 | 2,064.0 | 6-7 | 17.3 | 1.4 | .... | 0.9 | .... | .... | .... | [11]5.2 |
| Petromer Trend Corp.—Arar, Arar-Klalin field, Irian Jaya Province, Kepala Burung | 15.0 | 12.0 | 6 | .... | .... | .... | .... | .... | .... | 20.0 | .... |
| Walio, Irian Jaya Province, Kepala Burung | 2.5 | 2.5 | 6 | .... | .... | .... | .... | .... | .... | 4.0 | .... |
| Petromina—Mundu, Jatibarang, West Java | 35.0 | 23.5 | 3 | .... | .... | .... | .... | 33.0 | 16.2 | .... | .... |
| Rantau, North Sumatra | 28.0 | 17.5 | 1 | .... | .... | .... | .... | 18.6 | .... | .... | .... |
| Total Indonesie—Handil CPA, East Kalimantan | 200.0 | 160.0 | [12-13]2 | .... | .... | .... | .... | .... | 45.0 | .... | .... |
| Senipah Terminal, East Kalimantan | 25.0 | 20.0 | [13]1 | .... | .... | .... | .... | .... | 16.0 | .... | .... |
| Unocal—Santan LEX, Attaka, East Kalimantan | 145.0 | 136.7 | 7 | .... | 142.6 | .... | .... | .... | 185.2 | .... | .... |
| **Total** | **3,900.5** | **3,496.2** |  | **17.3** | **345.6** | **113.4** | **0.9** | **51.6** | **1,462.4** | **24.0** | **5.2** |

† Butane +

## ITALY

| Company, plant, location | Gas capacity | Gas throughput | Process/condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AGIP SPA—Brugherio, Po Valley | 300.0 | 13.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Casalborsetti, Porto Garibaldi field, Bologna, Emilia-Romagna, Po Valley | 796.0 | 367.0 | 1 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Casirate d'Adda, Malossa field, Bergamo, Lombardia, Po Valley | 53.0 | 10.0 | 2 | .... | .... | .... | .... | 2.7 | 8.0 | .... | .... |
| Cortemaggiore, Piacenza, Po Valley | 106.0 | 28.0 | 1 | .... | .... | .... | .... | .... | .... | 0.1 | .... |
| Crotone, Luna field, Catanzaro, Calabria | 265.0 | 141.0 | 1 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Falconara, Barbara 'A' field, Ancona | 177.0 | 112.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Fano, Basil, Pesaro | 177.0 | 27.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| *Gagliano, Enna, Sicily | 142.0 | 11.0 | 5 | .... | .... | .... | .... | .... | .... | 6.5 | .... |
| Grottammare, Emilio-David field, Ascoli Piceno | 115.0 | 51.0 | 1-2 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Hera Lacinia, Crotone, Catanzaro | 88.0 | 22.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Minerbio, Bologna, Po Valley | 1,910.0 | 125.0 | 1 | .... | .... | .... | .... | .... | .... | <0.1 | .... |
| Pineto, Fratello-Squalo-Emma field, Roseto, Pescara | 177.0 | 86.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ravenna Mare, Porto Corsini Est-Angela fields, Bologna, Emilia Romagna, Po Valley | 354.0 | 242.0 | 1 | .... | .... | .... | .... | .... | .... | 0.3 | .... |
| Ripalta, Cremona, Po Valley | 354.0 | 77.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Rubicone, Cervia and Cesenatico fields, Bologna, Emilia-Romagna, Po Valley | 265.0 | 147.0 | 1 | .... | .... | .... | .... | .... | .... | 0.2 | .... |
| Sergnano, Cremona, Po Valley | 1,981.0 | 51.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Settala, Po Valley | 354.0 | 77.0 | 1 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **7,614.0** | **1,587.0** |  | **....** | **....** | **....** | **....** | **2.7** | **8.0** | **7.5** | **....** |

## KUWAIT

| Company, plant, location | Gas capacity | Gas throughput | Process/condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kuwait National Petroleum Co.— |  |  |  |  |  |  |  |  |  |  |  |
| Mina Al-Ahmadi-1 | † | † | † | .... | (290.8) | (348.3) | .... | .... | .... | (320.5) | .... |
| Mina Al-Ahmadi-2 | † | † | † | .... | (541.5) | (648.5) | .... | .... | .... | (596.8) | .... |
| *Mina Al-Ahmadi | 1,815.0 | NR | 1-[28-12]2<br>4-[23]5 | .... | 1,722.0 | .... | 980.0 | .... | .... | 811.8 | .... |
| **Total** | **1,815.0** | **1,452.0** |  | **....** | **1,722.0** | **....** | **980.0** | **....** | **....** | **811.8** | **....** |

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†Fractionation. (Figures in parenthesis do not represent primary production, and are not included in totals).

## LIBYA

| Company, plant, location | Gas capacity | Gas throughput | Process/condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oasis Oil Co. of Libya Inc.— |  |  |  |  |  |  |  |  |  |  |  |
| *Bahi, Concession 32 | 15.0 | 10.0 | 2-4 | .... | .... | .... | .... | .... | .... | .... | [11]160.0 |
| *Dahra, Concession 32 | 140.0 | 20.0 | 2-4 | .... | .... | .... | .... | .... | .... | .... | [11]11.0 |
| Defa, Concession 59 and 71 | 104.0 | 47.0 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]210.0 |
| Waha, Concession 59W | 52.0 | 52.0 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]170.0 |
| Occidental of Libya, Inc.— |  |  |  |  |  |  |  |  |  |  |  |
| 103A, Sirte Basin, Petroleum Zone II | 670.0 | 450.0 | 3 | .... | .... | .... | .... | .... | 666.0 | .... | .... |
| 103D, Sirte Basin, Petroleum Zone II | 420.0 | 255.0 | 3 | .... | .... | .... | .... | .... | 375.0 | .... | .... |
| Socialist People's Libyan Arab Jamahirya, Marsa Brega | 450.0 | 393.0 | NR | .... | .... | .... | .... | 37.8 | 4,536.0 | .... | .... |
| **Total** | **1,651.0** | **1,227.0** |  | **....** | **....** | **....** | **....** | **37.8** | **5,577.0** | **....** | **551.0** |

| | MMcfd | | | Production—1,000 gpd (Average based on the past 12 months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Company, plant, location | Gas capacity | Gas through-put | Process/ condition method | Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
| **MALAYSIA** | | | | | | | | | | | |
| Petronas—Dew Point Control Unit, Kerteh, Terengganu | 250.0 | 74.0 | 6-7 | .... | 23.2 | .... | 28.2 | .... | .... | 57.0 | .... |
| LPG Unit, Kerth Kemaman, Terengganu | 32.0 | 31.0 | [19-26]2 | 161.4 | .... | 136.3 | .... | .... | .... | 97.1 | .... |
| **Total** | **282.0** | **105.0** | | **161.4** | **23.2** | **136.3** | **28.2** | **....** | **....** | **154.1** | **....** |
| **MEXICO** | | | | | | | | | | | |
| Petroleos Mexicanos—Cactus, Chiapas (6 plants) | 1,450.0 | 975.7 | 6-7 | †4,424.7 | .... | .... | .... | .... | .... | .... | .... |
| Ciudad Pemex A, Tabasco | 550.0 | 286.7 | [19]2 | †387.4 | .... | .... | .... | .... | .... | .... | .... |
| Cuidad Pemex C, Tabasco | 200.0 | 182.0 | 7 | †811.1 | .... | .... | .... | .... | .... | .... | .... |
| La Venta A, Tabasco | 200.0 | 162.4 | [19]2 | †521.2 | .... | .... | .... | .... | .... | .... | .... |
| La Venta C, Tabasco | 182.0 | 212.0 | 7 | †967.9 | .... | .... | .... | .... | .... | .... | .... |
| Matapionche, Veracruz | 50.0 | 40.7 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]9.5 |
| Nuevo Pemex, Tabasco | 500.0 | 443.0 | 7 | †2,353.9 | .... | .... | .... | .... | .... | .... | .... |
| Nuevo Pemex, Tabasco | 500.0 | 374.0 | 7 | †1,987.2 | .... | .... | .... | .... | .... | .... | .... |
| Pajaritos, Coatzacoalcos, Veracruz | 192.0 | 143.3 | 7 | †272.6 | .... | .... | .... | .... | .... | .... | .... |
| Poza Rica, Veracruz | 275.0 | 295.1 | 7 | †678.9 | .... | .... | .... | .... | .... | .... | .... |
| Reynosa, Tamaulipas | 550.0 | 255.5 | [19]2 | †300.0 | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **4,649.0** | **3,370.4** | | **12,704.9** | **....** | **....** | **....** | **....** | **....** | **....** | **9.5** |
| †$C_2$+ | | | | | | | | | | | |
| **NETHERLANDS** | | | | | | | | | | | |
| Amoco Netherlands Petroleum Co.—Alkmaar, (Koedijk), Bergen, Bergenmeer, Groet, Schermer, North Holland | **350.0** | **35.0** | [32]5 | .... | .... | .... | .... | .... | .... | .... | **[11]4.2** |
| **NEW ZEALAND** | | | | | | | | | | | |
| Natural Gas Corp. of New Zealand— | | | | | | | | | | | |
| *Kapuni, Taranaki, Lot 1. Dp 5227, Sec. 11, B-XVI, Kaupokouni SD area 11.2.27 | 100.0 | 57.0 | [7]1-3 | .... | 39.0 | .... | .... | .... | .... | 9.0 | .... |
| *Kapuni | 152.0 | 37.0 | 3 | .... | .... | .... | .... | .... | .... | .... | .... |
| Petrochem— | | | | | | | | | | | |
| Kapuni, Waimate West | 100.0 | 50.0 | [14,13]1-3<br>-4 | .... | .... | .... | 0.7 | 37.7 | .... | 9.6 | .... |
| Kapuni, Waimate West | 152.0 | 43.0 | [13]1-3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Shell BP and Todd Oil Services Ltd.— | | | | | | | | | | | |
| *Kapuni, Taranaki | 300.0 | 121.0 | 4 | .... | .... | .... | .... | .... | .... | .... | [11]209.7 |
| Maui, Oaonui, Taranaki | 600.0 | 318.0 | [11-24]2 | .... | <0.1 | .... | 1.1 | 97.0 | .... | .... | [11]524.0 |
| **Total** | **1,152.0** | **533.0** | | **....** | **39.1** | **....** | **1.8** | **134.7** | **....** | **18.6** | **733.7** |
| **NORWAY** | | | | | | | | | | | |
| Amoco Norway Oil Co. Valhall A, 56° 1[illegible]' 41.395" North, 3° 23' 43.193" East | 350.0 | 70.0 | 7 | .... | .... | .... | .... | .... | 200.0 | .... | .... |
| Statoil—Statpipe, Tysvaer, Rogaland | [illegible].0 | 437.0 | 7 | .... | 682.0 | 108.0 | 256.0 | .... | .... | 193.0 | .... |
| **Total** | **950.0** | **507.0** | | **....** | **682.0** | **108.0** | **256.0** | **....** | **200.0** | **193.0** | **....** |
| **OMAN** | | | | | | | | | | | |
| Sultanate of Oman—Fahud | 50.0 | 25.0 | 3 | .... | .... | .... | .... | .... | 12.0 | .... | .... |
| Rima | 2.0 | 1.4 | 4-8 | .... | .... | .... | .... | .... | .... | 13.0 | .... |
| Saih Nihayda | 80.0 | 24.0 | 3 | .... | .... | .... | .... | .... | 5.0 | .... | .... |
| Sayyala | 14.0 | 7.0 | 4-8 | .... | .... | .... | .... | .... | .... | 30.0 | .... |
| Yibal | 80.0 | 72.0 | 3 | .... | .... | .... | .... | .... | 185.0 | .... | .... |
| Yibal | † | † | † | .... | (0.5) | .... | (8.0) | .... | .... | .... | .... |
| Yibal A-B-X | 200.0 | 80.0 | 3-6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Yibal C-D | 200.0 | 100.0 | 6-7 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **626.0** | **309.4** | | **....** | **....** | **....** | **....** | **....** | **202.0** | **43.0** | **....** |
| †Fractionation. (Figures in parenthesis do not represent primary production, and are not included in totals). | | | | | | | | | | | |
| **PAKISTAN** | | | | | | | | | | | |
| Oil and Gas Development Corp.— | | | | | | | | | | | |
| Loti field, Baluchistan province | 20.0 | .... | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pirkoh field, Baluchistan province | 250.0 | 138.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Sari Hundi field, Sind province | 25.0 | .... | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Toot field, Punjab province | 20.0 | 7.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| Pakistan Oilfields Ltd.—*Meyel gas purification plant, Attock district, Punjab province | 40.0 | 17.4 | [21]1 | .... | .... | .... | .... | .... | .... | .... | [11]5.4 |
| *Meyel LPG plant, Attock district, Punjab province | 75.0 | 25.3 | 4-[23]5-7 | .... | .... | .... | .... | 48.8 | 6.1 | .... | [6]3.7 |
| Sui Northern Gas Pipeline Ltd.— | | | | | | | | | | | |
| Sui Gas Purification & Dehydration plant–Sui district dera bugti, Baluchistan | 790.0 | 670.0 | [21&35]1-[2]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **430.0** | **187.7** | | **....** | **....** | **....** | **....** | **48.8** | **6.1** | **....** | **9.1** |
| **PERU** | | | | | | | | | | | |
| Petroleos del Peru—Pariñas-Pozo, Piura, Talara | 70.0 | 37.0 | 2 | .... | .... | .... | .... | .... | .... | .... | .... |
| Verdun, Pariñas, Piura, Talara | .... | .... | ... | .... | 3.4 | .... | 1.0 | 5.6 | 28.9 | .... | 4.0 |
| **Total** | **70.0** | **37.0** | | **....** | **3.4** | **....** | **1.0** | **5.6** | **28.9** | **....** | **4.0** |
| **QATAR** | | | | | | | | | | | |
| Qatar General Petroleum Corp.— | | | | | | | | | | | |
| Umm Said No. 1, Dukhan field, onshore | 339.0 | 157.6 | 3 | .... | 259.4 | .... | 136.6 | .... | .... | 74.2 | .... |
| Umm Said No. 2, offshore | 240.0 | 74.4 | 1-3 | .... | 175.2 | .... | 118.9 | .... | .... | 98.8 | .... |
| **Total** | **579.0** | **232.0** | | **....** | **434.6** | **....** | **255.5** | **....** | **....** | **173.0** | **....** |

## SAUDI ARABIA

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Saudi Aramco.†—Abqaiq | 580.0 | NR | 3-4 | .... | .... | .... | .... | .... | .... | .... | .... |
| Berri | 600.0 | NR | [9]1-3-4<br>[23]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ras Tanura | 120.0 | NR | [9]1-3-4<br>[23]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Shedgum | 1,500.0 | NR | [9]1-3-4<br>[23]5 | .... | .... | .... | .... | .... | .... | .... | .... |
| Uthmaniyah | 1,500.0 | NR | [9]1-3-4<br>[23]5-6 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **4,300.0** | .... |  | .... | .... | .... | .... | .... | .... | .... | .... |

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†Design capacity. Fractionation plants located at Ju'Aymah, and Yanbu. Total LPG Plus natural gasoline produced from the seven plants = 45,850,000.0 gallons per day.

## SHARJAH

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco Sharjah Oil Co.—Condensate Sep. fac. Sajaa field | 550.0 | 500.0 | 8 | .... | .... | .... | .... | .... | .... | .... | [11]1,239.0 |
| Shalco LPG, Sajaa field | 440.0 | 425.0 | 7 | .... | 290.0 | .... | 214.0 | .... | .... | .... | .... |
| **Total** | **990.0** | **925.0** |  | .... | **290.0** | .... | **214.0** | .... | .... | .... | **1,239.0** |

## SPAIN

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Repsol Exploración SA— |  |  |  |  |  |  |  |  |  |  |  |
| *Gaviota P/F, Offshore Bermeo, Vizcaya, Concession I-II | 186.0 | 84.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | [11]31.0 |
| *Machichaco, Gaviota, Bermeo, Vizcaya | 186.0 | 84.0 | [35]2 | .... | .... | .... | .... | .... | .... | .... | [11]42.0 |
| *Serrablo Concession, Sabiñanigo, Huesca | 56.0 | 9.0 | [35]1 | .... | .... | .... | .... | .... | .... | .... | .... |
| **Total** | **428.0** | **177.0** |  | .... | .... | .... | .... | .... | .... | .... | **73.0** |

## THAILAND

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Petroleum Authority of Thailand— |  |  |  |  |  |  |  |  |  |  |  |
| Gas separation Plant I, Rayong, Mabtapud District | 350.0 | 350.0 | [23]5-[14]6 | .... | .... | .... | .... | 400.4 | .... | 84.0 | .... |
| Plant II, Dew Point Control, Rayong, Mabtapud District | 500.0 | 200.0 | 3 | .... | .... | .... | .... | .... | 8.4 | .... | .... |
| **Total** | **850.0** | **550.0** |  | .... | .... | .... | .... | **400.4** | **8.4** | **84.0** | .... |

## UNITED KINGDOM

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amoco U.K.—Bacton, Gordon-Forbes-Esmond, (43/8 13, 15); Leman (49/26 27, 28&53/1-2); Indefatigable (49/18 19-23&24) | 1,800.0 | 1,200.0 | 3 | .... | .... | .... | .... | .... | .... | .... | [11]40.0 |
| Northwest Hutton, 211/27 | 75.0 | 75.0 | 7 | .... | .... | .... | .... | .... | 150.0 | .... | .... |
| BP Petroleum Development UK Ltd.— |  |  |  |  |  |  |  |  |  |  |  |
| Easington and West Sole, Block 48/6, Southern North Sea | 300.0 | 168.0 | 1-2<br>4-5 | .... | .... | .... | .... | .... | .... | .... | [12]11.8 |
| Kinneil, Forties Field | 70.0 | 48.0 | 4 | .... | 332.0 | .... | 291.0 | .... | .... | 176.0 | .... |
| Shell UK Exploration & Production— |  |  |  |  |  |  |  |  |  |  |  |
| Bacton, Norfolk, Southern North Sea | 662.0 | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... |
| Mossmorran, Fife, North Sea | .... | .... | † | (Processed 2,492,493 tons NGL feedstock only) |  |  |  |  |  |  |  |
| St. Fergus, Aberdeenshire, North Sea | 760.0 | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... |
| Total Oil Marine Ltd.—Saint Fergus, Frigg field, Grampian province | 65.0 | 46.0 | 3 | .... | .... | .... | .... | .... | .... | 1,572.5 | .... |
| **Total** | **3,732.0** | **1,537.0** |  | .... | **332.0** | .... | **291.0** | .... | **150.0** | **1,748.5** | **51.8** |

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†Fractionation.

## VENEZUELA

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Corpoven |  |  |  |  |  |  |  |  |  |  |  |
| Guara Oeste, Anzoategui | 42.0 | 45.0 | 1 | .... | .... | .... | .... | 15.0 | .... | 11.5 | .... |
| Jose, Oriente, Anzoategui | .... | .... | † | .... | (996.0) | (264.4) | (316.7) | .... | .... | (336.8) | (17.0) |
| Oficina, Anzoategui | 9.0 | 3.0 | 1 | .... | .... | .... | .... | 6.3 | .... | 5.0 | .... |
| San Joaquin, Oriente, Anzoategui | 800.0 | 870.0 | 7 | .... | .... | .... | .... | .... | 1,930.9 | .... | .... |
| Santa Rosa, Anzoategui | 300.0 | 250.0 | 2 | .... | .... | .... | .... | 210.0 | .... | 71.4 | .... |
| Lagoven |  |  |  |  |  |  |  |  |  |  |  |
| Tia Juana 1, Zulia | 230.0 | 210.0 | 1 | .... | .... | .... | .... | .... | 180.2 | .... | .... |
| Tia Juana 2, Zulia | 450.0 | 450.0 | 3 | .... | .... | .... | .... | .... | 640.2 | .... | .... |
| Tia Juana 3, Zulia | 455.0 | 380.0 | 3 | .... | .... | .... | .... | .... | 300.7 | .... | .... |
| Ule fractionation plant, Punta Gorda Zulia | .... | .... | † | .... | (408.2) | (68.9) | (281.8) | .... | .... | (362.0) | .... |
| Maraven |  |  |  |  |  |  |  |  |  |  |  |
| Bajo Grande fractionation plant, Zulia | .... | .... | † | .... | (75.6) | .... | (71.4) | .... | .... | (75.6) | .... |
| El Tablazo, Zulia | 165.0 | 134.0 | 7 | 213.3 | 168.0 | .... | 88.2 | .... | .... | 67.2 | .... |
| *Lama Liquido, Zulia | 150.0 | 120.0 | 3 | .... | .... | .... | .... | .... | 197.4 | .... | .... |
| Lamar Liquido, Zulia | 162.0 | 25.0 | 3 | .... | .... | .... | .... | .... | 25.2 | .... | .... |
| La Paz, Zulia | 150.0 | 70.0 | 1 | .... | 29.4 | .... | 25.2 | .... | .... | 16.8 | .... |
| **Total** | **2,913.0** | **2,557.0** |  | **213.3** | **197.4** | ... | **113.4** | **231.3** | **3,274.6** | **171.9** | .... |

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†Figures in parenthesis do not represent primary production, and are not added to totals. Jose plant fractionates raw NGL mix from San Joaquin and Santa Rosa plants. Ule plant fractionates all raw NGL mix from Lagoven plants. Bajo Grande plant fractionates raw NGL mix from Lama and Lamar Liquido plants.

## YEMEN

| Company, plant, location | MMcfd<br>Gas capacity | MMcfd<br>Gas throughput | Process/condition method | Production—1,000 gpd (Average based on the past 12 months)<br>Ethane | Prop. | Isobut. | Normal or unsplit butane | LP-gas mix | Raw NGL mix | Debut. nat. gaso. | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Yemen Hunt Oil Co.—*Alif field, Marib/Al Jawf basin | **400.0** | **324.0** | [1]2 | .... | .... | .... | .... | **120.0** | **189.0** | .... | .... |

# World sulfur derived from oil, gas production

**Lou Ann Thrash**
Director of Editorial Surveys

As of Jan. 1, 1990

| Company and location | Source | Type of process | – Metric tons/day – | |
|---|---|---|---|---|
| | | | Design capacity | Production |
| **ABU DHABI** | | | | |
| Abu Dhabi National Oil Co. | | | | |
| Thammama C, Habshan | nat. gas | 3 bed Claus | 800.0 | 400.0 |
| Ruwais | ref. gas | 2 bed Claus | 93.0 | 52.0 |
| **ARGENTINA** | | | | |
| Duperial | | | | |
| San Lorenzo | acid gas | Claus | 44.2 | 0 |
| Electroclor SAIC | | | | |
| Capitan Bermudez, Santa Fe | carb. disulf | Chlorination | 13.8 | 12.6 |
| **AUSTRALIA** | | | | |
| BP Australia | | | | |
| Bulwer Island | ref. gas | Claus | 25.0 | 8.0 |
| Kwinana | ref. gas | Claus | 35.0 | 30.0 |
| Caltex Refining Co. Pty. Ltd. | | | | |
| Kurnell, NSW | ref. gas | Claus | 45.7 | 20.0 |
| Petroleum Refineries Australia Pty Ltd. | | | | |
| Adelaide | ref. gas | . . . . | 26.0 | 0.6 |
| Altona | ref. gas | . . . . | 25.0 | 1.2 |
| Shell Refining (Australia) | | | | |
| Clyde, NSW | ref. gas | Claus-DEA | 115.0 | 5.0 |
| Geelong, Victoria | ref. gas | Claus-DEA | 100.0 | 9.0 |
| **AUSTRIA** | | | | |
| OeMV AG | | | | |
| Aderklaa | sour gas | Claus | 55.0 | 30.0 |
| Schwechat | ref. gas | Claus | 180.0 | 69.0 |
| Schwechat | flue gas | Claus | 34.0 | 12.0 |
| **BAHRAIN** | | | | |
| Bahrain Petroleum Co. BSC (Closed) | | | | |
| Sitra | ref. gas | Mod. Claus | 150.0 | 142.0 |
| **BELGIUM** | | | | |
| Belgian Refining Corp. | | | | |
| Antwerp | ref. gas | Claus 3 stage | 108.0 | 25.0 |
| Esso Belgium | | | | |
| Antwerp | ref. gas | 2 Claus<br>1 IFP | 350.0 | 260.0 |
| Fina Raffinaderij Antwerpen | | | | |
| Antwerp | ref. gas | Claus | 225.0 | 110.0 |
| **BRAZIL** | | | | |
| Petrobras | | | | |
| Refap—Canoas, RS | ref. gas | Claus | 25.0 | 12.0 |
| Regap—Betim, MG | ref. gas | Claus | 60.0 | 58.0 |
| Repar—Araucária, PR | ref. gas | Claus | 65.0 | 33.0 |
| Replan—Paulínia, SP | ref. gas | Claus | 60.0 | 38.0 |
| Revap—São Jose Campos, SP | ref. gas | Claus | 170.0 | 26.0 |
| Six—Sao Mateus do Sul, PR | ref. gas | Claus | 23.0 | 16.0 |
| Petroflex SA | | | | |
| Duque de Caxias, RJ | ref. gas | Claus | 40.0 | 30.0 |
| Ultrafertil SA | | | | |
| Araucária, PR | resid asphalt | Claus Pool 1500 | 57.8 | 33.0 |
| Cubatão, SP | ref. gas | Claus | 45.0 | 19.0 |
| **CANADA** | | | | |
| AEC Oil & Gas Co. | | | | |
| Hythe-Brainard, Al. | nat. gas | MCRC | 120.0 | 70.0 |
| Amoco Canada Petroleum Co. Ltd. | | | | |
| Bigstone, Al. | nat. gas | 2 bed Mod. Claus | 385.0 | 300.0 |
| Brazeau, Al. | nat. gas | 2 bed Claus | 110.0 | 42.0 |
| Caroline, Al. | nat. gas | 2 bed Claus | 8.3 | 6.0 |
| Caroline (Garr), Al. | nat. gas | Recycle Selectox | 10.4 | . . . . |
| East Crossfield, Al. | nat. gas | 2 bed Claus and CBA | 1,797.0 | 858.0 |
| Edson, Al. | nat. gas | 3 bed Claus | 288.0 | 95.0 |
| Kaybob I-II, Al. | nat. gas | 3 bed Claus & Sulfreen | 1086.0 | 482.0 |
| Lone Pine, Al. | nat. gas | 3 bed Claus | 283.0 | 89.0 |
| Steelman, Sask. | nat. gas | Mod. Claus | 7.0 | . . . . |
| Sturgeon Lake, Al. | nat. gas | 2 bed Claus | 98.0 | 64.0 |
| West Pembina, Al. | nat. gas | 2 bed Claus and CBA | 340.0 | 233.0 |
| West Whitecourt, Al. | nat. gas | 2 bed Claus | 1,330.0 | 1,031.0 |
| Zama, Al. | nat. gas | 2 bed Claus | 74.0 | 32.0 |
| Canadian Occidental Petroleum Ltd. | | | | |
| Mazeppa, Al. | nat. gas | . . . . | 580.0 | 200.0 |
| Chevron Canada Ltd. | | | | |
| Burnaby, BC | ref. gas | Stretford | 10.0 | . . . . |
| Chevron Canada Resources Ltd. | | | | |
| Kaybob, South Al. | nat. gas | Mod. Claus | 3,200.0 | . . . . |
| Consumers Cooperative Refineries Ltd. | | | | |
| Regina, Saskatchewan | sour gas | 3 stage Claus | 270.0 | 135.0 |
| Esso Resources Canada Ltd. | | | | |
| Bonnie Glen | solution gas | Claus | 12.5 | 4.0 |
| Joffre | solution gas | Claus | 23.5 | 14.8 |
| Quirk Creek | nat. gas | Claus-MCRC | 299.0 | 236.5 |
| Redwater | solution gas | Claus | 11.0 | 5.9 |
| Gulf Canada Corp. | | | | |
| Hanlan-Robb, Al. | nat. gas | Mod. Claus Sulfreen-TG | 1,100.0 | 520.0 |
| Nevis, Al. | nat. gas | Mod. Claus Sulfreen-TG | 163.0 | 110.0 |
| Rimbey, Al. | nat. gas | Mod. Claus | 333.0 | 100.0 |
| Strachan, Al. | nat. gas | 4 bed Amoco Cold bed adsorption | 1,000.0 | 450.0 |
| Husky Oil Operations Ltd. | | | | |
| Nordegg River, Al. | nat. gas | Mod. Claus 2 stage | 40.0 | 22.0 |
| Okotoks, Al. | nat. gas | Mod. Claus 2 stage | 440.0 | 420.0 |
| Rainbow Lake, Al. | oil and gas | Mod. Claus 2 stage | 150.0 | 60.0 |
| Ram River, Al. | nat. gas | Mod. Claus 2 stage Sulfreen | 4,600.0 | 2,900.0 |
| Mobil Oil Canada Ltd. | | | | |
| Harmattan, Al. | nat. gas | Claus | 45.0 | 36.0 |
| Lone Pine Creek So., Al. | nat. gas | Claus | 157.0 | 94.0 |
| Teepee Creek, Al. | nat. gas | Claus | 30.0 | 16.0 |
| Wimborne, Al. | nat. gas | Claus | 182.0 | 94.0 |
| Norcen Energy Resources Ltd. | | | | |
| Minnehik-Buck Lake, Al. | nat. gas | Claus 2 stage | 35.0 | 22.0 |
| Pembina Resources Ltd. | | | | |
| Hartell, Al. | nat. gas | Claus 3 stage | 10.7 | 10.7 |
| Petro-Canada Inc. | | | | |
| Brazeau, Al. | sour gas | 3 bed MCRC | 90.0 | 80.0 |
| Gold Creek, Al. | nat. gas | Claus 2 stage | 100.0 | 13.5 |
| Wildcat Hills, Al. | sour gas | Claus 2 stage | 163.0 | 75.0 |
| Petrogas Processing Ltd. | | | | |
| Balzac, Al. | nat. gas | Amine<br>Claus<br>Sulfreen | 1,700.0 | 750.0 |
| Saratoga Processing Co. Ltd. | | | | |
| Coleman, Al. | sour gas | Mod. Claus | 400.0 | 348.0 |
| Shell Canada Ltd. | | | | |
| Sarnia, Ont. | ref. gas | Claus | 35.0 | 15.0 |
| Scotford, Al. | ref. gas | Claus | 10.0 | 43.0 |
| Vancouver, BC | ref. gas | Claus-Scot | 15.0 | 6.0 |
| Shell Canada Ltd. | | | | |
| Burnt Timber, Al. | nat. gas | Claus | 510.0 | 475.0 |
| Jumping Pound, Al. | nat. gas | Claus | 570.0 | 543.0 |
| Progress, Al. | nat. gas | Claus-MCRC | 13.0 | 5.0 |
| Rosevear, Al. | nat. gas | Claus | 170.0 | 90.0 |
| Simonette, Al. | nat. gas | Claus | 100.0 | 76.0 |
| Waterton, Al. | nat. gas | Claus-Scot | 2,900.0 | 2,297.0 |
| Sulconam Inc. | | | | |
| Montreal East, Que. | ref. gas | Claus 3 stage | 300.0 | 125.0 |
| Suncor Inc. | | | | |
| Ft. McMurray, Al. | oil sands | Claus 3 stage | 815.0 | 315.0 |
| Rosevear, Al. | nat. gas | Claus 3 stage | 115.0 | 67.0 |
| Sarnia, Ont. | ref. gas | . . . . | . . . . | 14.0 |
| Syncrude Canada Ltd. | | | | |
| Mildred Lake, Al. | oil sands | Mod. Claus 3 stage | 530.0 | 320.0 |
| | oil sands | Mod. Claus 3 stage | 530.0 | 320.0 |
| | oil sands | Mod. Claus 2 stage | 700.0 | 470.0 |
| | oil sands | Sulfreen TG | 96.0 | 55.0 |

| Company and location | Source | Type of process | – Metric tons/day – Design capacity | Production |
|---|---|---|---|---|
| Texaco Canada Resources Ltd. | | | | |
| Bonnie Glen, Al. | solution gas | Mod. Claus | 15.2 | 8.0 |
| Westcoast Energy Inc. | | | | |
| Chetwynd, BC | sour gas | MCRC | 1,034.0 | 496.0 |
| Fort Nelson, BC | sour gas | Mod. Claus<br>Sulfreen | 650.0 | 301.0 |
| Taylor, BC | sour gas | Mod. Claus | 460.0 | 295.0 |
| **CHINA, TAIWAN** | | | | |
| Chinese Petroleum Corp. | | | | |
| Kaohsiung-2 | ref. gas | Parsons | 45.0 | 5.0 |
| Kaohsiung-3 | ref. gas | Parsons | 45.0 | 1.0 |
| Kaohsiung-4 | ref. gas | Amoco | 117.0 | 25.0 |
| Kaohsiung-5 | ref. gas | Amoco | 200.0 | 81.0 |
| Kaohsiung-6 | ref. gas | Amoco | 200.0 | 47.0 |
| Taoyuan-2 | ref. gas | Amoco | 120.0 | 13.0 |
| Taoyuan-3 | ref. gas | Amoco | 200.0 | 57.0 |
| **COLOMBIA** | | | | |
| Empresa Colombiana de Petroleos | | | | |
| Barrancabermeja | ref. gas | Claus | 50.0 | 30.0 |
| Barrancabermeja | ref. gas | Claus | 15.0 | 10.0 |
| **DENMARK** | | | | |
| A/S Dansk Shell | | | | |
| Fredericia | ref. gas | Claus | 25.0 | 3.0 |
| Kuwait Petroleum Refining Denmark A/S | | | | |
| Gulfhavn | refinery | Claus | 50.0 | 45.0 |
| **EGYPT** | | | | |
| Ameria Petroleum Refining Co. | | | | |
| Alexandria | HDS gases | Claus | .... | 3.1 |
| General Petroleum Co. | | | | |
| Ras Gharib | assoc. gas | Claus | .... | 8.7 |
| Suez Oil Processing Co. | | | | |
| El-Suez | ref. gas<br>coker gas | Claus | 81.5 | 9.1 |
| **FINLAND** | | | | |
| Neste Oy | | | | |
| Naantali | ref. gas | Claus | 55.0 | 26.0 |
| Porvoo | ref. gas | Claus | 215.0 | 116.0 |
| **FRANCE** | | | | |
| Cie. de Raff. et de Distillation Total France | | | | |
| Gonfreville l'Orcher | ref $H_2S$ | Claus | 190.0 | 70.7 |
| La Mede | ref $H_2S$ | Claus | 190.0 | 42.4 |
| Mardyck | ref $H_2S$ | Claus | 130.0 | 36.5 |
| Cie. Rhenane de Raffinage | | | | |
| Reichstett | refinery | Claus | 55.0 | 10.0 |
| Elf France | | | | |
| Donges | refinery | Claus | 210.0 | 77.0 |
| Feyzin | refinery | Claus | 118.0 | 37.3 |
| Grandpuits | refinery | Claus | 125.0 | 20.3 |
| Esso SA Francaise | | | | |
| Fos-sur-Mer | refinery | Claus | 190.0 | 61.0 |
| Shell Francaise | | | | |
| Berre | refinery | Claus | 210.0 | 25.0 |
| Petit-Couronne | refinery | Claus | 210.0 | 30.0 |
| Ste. Francaise des Petroles BP | | | | |
| Lavera | ref. gas | Claus | 194.0 | 178.0 |
| Ste. Francaise Hoechst | | | | |
| Port Jerome | ref. gas | Claus | 240.0 | .... |
| Ste. Nationale Elf Aquitaine | | | | |
| Lacq | sour gas | Claus<br>Sulfreen | .... | 2,093.1 |
| **GERMANY** | | | | |
| DEA Mineralol AG | | | | |
| Wesseling | refinery | Claus | 375.0 | 85.0 |
| Deutsche BP AG | | | | |
| Vohburg | ref. gas | Claus | 88.0 | 55.0 |
| DMP Mineralol | | | | |
| Burghausen | ref. gas | Claus | 33.0 | 15.0 |
| Deutsche Shell | | | | |
| Godorf | refinery | Claus-Scot | 140.0 | 75.0 |
| Harburg | refinery | Claus-Scot | 78.5 | 20.0 |
| Deutsche Texaco | | | | |
| Heide | ref. gas | 2 Claus<br>Maxisulf | 57.0 | 21.0 |
| Erdgasaufbereitungsanlage | | | | |
| Grossenkneten | nat. gas | .... | 2,100.0 | 1,527.0 |
| Erdölraffinerie Ingolstadt AG | | | | |
| Ingolstadt | gas oil | CBA TG and Claus | 27.0 | 10.0 |
| Erdol-Raffinerie Neustadt GmbH & Co. oHG | | | | |
| Neustadt-Donau | refinery | Claus<br>Sulfreen | 75.0 | 18.0 |
| Esso | | | | |
| Ingolstadt | refinery | Claus<br>Sulfreen | 50.0 | 34.0 |
| Karlsruhe | refinery | Claus<br>Sulfreen | 100.0 | 57.0 |
| Mobil Oil AG | | | | |
| Woerth | ref. gas | .... | 60.0 | 9.3 |
| Mobil AG-Norddeutsche Erdgas Aufbereitungs | | | | |
| Sulingen | nat. gas | Claus | 1,050.0 | 541.0 |
| OMW GmbH | | | | |
| Karlsruhe | ref. gas | Claus<br>Sulfreen | 225.0 | .... |
| Ruhr Oel GMBH | | | | |
| Gelsenkirchen | refinery | Claus-Scot & Sulfreen | 445.0 | 174.0 |
| Wintershall AG | | | | |
| Lingen | ref. gas | Claus | 112.0 | 50.0 |
| Ruetenbrock | nat. gas | Claus | 7.4 | 7.1 |
| **GREECE** | | | | |
| Hellenic Aspropyrgos Refinery SA | | | | |
| Aspropyrgos, Attiki | ref. gas | Claus | 40.0 | .... |
| Aspropyrgos, Attiki | ref. gas | Claus | 200.0 | 110.0 |
| Motor Oil Hellas | | | | |
| Corinth | ref. gas | Claus | 90.0 | 38.0 |
| **HUNGARY** | | | | |
| Danube Petroleum Refining Co. | | | | |
| Szazhalombatta | ref. gas | Claus | 77.0 | 60.0 |
| Tisza Petroleum Refining Co. | | | | |
| Leninvaros | ref. gas | Claus | 24.0 | 5.3 |
| **ISRAEL** | | | | |
| Oil Refineries Ltd. | | | | |
| Ashdod | HDS & visb | Claus TGT | 30.0 | 30.0 |
| Haifa | FCC | Claus TGT | 60.0 | 30.0 |
| Haifa | HDS & visb | Claus TGT | 60.0 | 30.0 |
| **ITALY** | | | | |
| Agip Plus SpA | | | | |
| Livorno | ref. gas | Claus | 60.0 | .... |
| Agip Raffinazione SpA | | | | |
| Rho | ref. gas | Claus | 50.0 | 31.6 |
| Sannazzarro | ref. gas | Claus | 90.0 | 36.0 |
| Taranto | ref. gas | Claus | 121.0 | 55.0 |
| Venezia | refinery | Claus | 50.0 | 24.0 |
| API-Raffineria di Ancona SpA | | | | |
| Falconara | ref. gas | Claus-1 | 41.0 | 35.0 |
| | ref. gas | Claus-2 | 34.0 | 20.0 |
| Esso Italiana | | | | |
| Augusta | ref. gas | Claus | 104.0 | 104.0 |
| Trecate | ref. gas | Claus | 98.0 | 35.0 |
| Isab | | | | |
| Melilli | refinery | Claus | 310.0 | 214.0 |
| Mobil Oil Italiana | | | | |
| Naples | ref. gas | .... | 70.0 | 20.9 |
| Raffineria Mediterranea SrL | | | | |
| Milazzo | ref. gas | Claus | 100.0 | .... |
| Saras | | | | |
| Sarroch | ref. gas | Parsons | 35.0 | (spare) |
| Sarroch | ref. gas | Parsons | 90.0 | 75.0 |
| Tamoil Italia SpA | | | | |
| Cremona | ref. gas | Claus | 12.0 | 8.1 |
| Cremona | ref. gas | Claus | 30.0 | 8.3 |
| **JAPAN** | | | | |
| Asia Oil Co. Ltd. | | | | |
| Sakaide | ref. gas | Parsons | 80.0 | 42.0 |
| Sakaide | ref. gas | Uhde | 185.0 | 110.0 |
| Yokohama | ref. gas | Parsons | 200.0 | .... |
| Cosmo Oil Co. Ltd. | | | | |
| Chiba | ref. gas | Parsons | 600.0 | 260.0 |
| Sakai | ref. gas | Parsons | 140.0 | 50.0 |
| Yokkaichi | ref. gas | Parsons | 200.0 | 45.0 |
| Fuji Oil Co. Ltd. | | | | |
| Sodegaura, Chiba | ref. gas | Comprimo | 150.0 | 121.9 |
| Sodegaura, Chiba | ref. gas | Parsons | 90.0 | .... |
| General Sekiyu KK | | | | |
| Sakai | ref. gas | Claus & Flexsorb SE | 193.0 | 130.0 |
| Idemitsu Kosan Co. Ltd. | | | | |
| Aichi | ref. gas | Uhde | 400.0 | 196.0 |
| Chiba | ref. gas | Uhde-Parsons | 800.0 | 265.0 |
| Hokkaido | ref. gas | Comprimo | 50.0 | 26.0 |
| Hyogo | ref. gas | Parsons | 230.0 | 105.0 |
| Tokuyama | ref. gas | Girdler-Uhde | 235.0 | 69.0 |
| Kashima Oil Co. Ltd. | | | | |
| Kashima | ref. gas | Parsons | 240.0 | 150.0 |

| Company and location | Source | Type of process | – Metric tons/day – Design capacity | Production |
|---|---|---|---|---|
| Koa Oil Co Ltd. | | | | |
| Marifu | ref. gas | Parsons | 45.0 | 29.0 |
| Marifu | ref. gas | Comprimo | 35.0 | 0.0 |
| Osaka | ref. gas | Parsons | 60.0 | 35.0 |
| Kyokuto Petroleum Industries Ltd. | | | | |
| Chiba | ref. gas | . . . . | 215.0 | 21.3 |
| Nichimo Sekiyu KK | | | | |
| Kawasaki | refinery | . . . . | 22.6 | . . . . |
| Nippon Mining Co. Ltd. | | | | |
| Chita, Aichi | ref. gas | Uhde-Claus | 150.0 | 60.0 |
| Mizushima | ref. gas | Uhde-Claus | 200.0 | 90.0 |
| Mizushima | ref. gas | Comprimo Claus | 200.0 | 90.0 |
| Nippon Petroleum Refining Co. Ltd. | | | | |
| Muroran | ref. gas | Parsons | 420.0 | 101.0 |
| Negishi | ref. gas | Parsons | 320.0 | 166.0 |
| Nippon Steel Chemical Co. Ltd. | | | | |
| Oita | BTX refin. | Scot | 3.0 | 3.0 |
| Tobata | coke oven gas | Claus | 2.1 | 2.1 |
| Okinawa Sekiyu Seisei Co. Ltd. | | | | |
| Okinawa City | refinery | . . . . | 300.0 | 180.0 |
| Seibu Oil Co. | | | | |
| Yamaguchi | refinery | . . . . | 320.0 | . . . . |
| Showa Oil Co. | | | | |
| Kawasaki | fuel oil | . . . . | 80.0 | . . . . |
| Showa Yokkaichi Seikyu KK | | | | |
| Yokkaichi | ref. gas | . . . . | 280.0 | . . . . |
| Toa Nenryo Kogyo KK | | | | |
| Kawasaki | ref. gas | Claus | 295.0 | 66.0 |
| Wakayama | ref. gas | Claus | 169.0 | 62.0 |
| Toa Oil Co. | | | | |
| Kawasaki | HDS gases | Claus | 330.0 | 206.0 |
| **KOREA** | | | | |
| Ssangyong Refining Co. Ltd. | | | | |
| Onsan | ref. gas | Claus | 43.8 | 28.4 |
| **KUWAIT** | | | | |
| Kuwait National Petroleum Co. | | | | |
| Mina Abdullah | ref. gas | Claus | 959.0 | 300.0 |
| Mina Al-Ahmadi | ref. gas | Claus | 1,335.0 | 700.0 |
| Shuaiba | ref. gas | Claus | 600.0 | 280.0 |
| **MEXICO** | | | | |
| Petroleos Mexicanos | | | | |
| Azcapotzalco, DF | ref. gas | Claus | 22.6 | 20.2 |
| Cadereyta, Ver. | ref. gas | Claus | 71.2 | 10.9 |
| Cactus, Chis | nat. gas | Claus | 1,302.0 | 628.3 |
| Cuidad Madero, Tamps | ref. gas | Claus | 54.8 | 24.8 |
| Ciudad Pemex, Tab. | nat. gas | Claus | 650.9 | 332.4 |
| Matapionche, Ver. | nat. gas | Claus | 27.1 | 12.2 |
| Minatitlan, Ver. | ref. gas | Claus | 71.2 | 12.3 |
| Nuevo Pemex, Tab. | nat. gas | Claus | 650.9 | 238.4 |
| Poza Rica, Ver | nat. gas | Claus | 126.6 | 51.2 |
| Salamanca, Gto | ref. gas | Claus | 153.4 | 11.3 |
| Salina Cruz, Oax. | ref. gas | Claus | 71.2 | 23.7 |
| Tula, Hgo | ref. gas | Claus | 153.7 | 28.2 |
| **NETHERLANDS** | | | | |
| BP Raffinaderij Nederland NV | | | | |
| Rotterdam | ref. gas | Claus | 270.0 | 120.0 |
| Esso Nederland | | | | |
| Rotterdam | refinery | Claus-TGC | 564.0 | 250.0 |
| Kuwait Petroleum Europoort BV | | | | |
| Europoort | refinery | Claus | 48.7 | 44.0 |
| Nederlandse Aardolie Maat. BV | | | | |
| Emmen | nat. gas | Sulfinol Claus | 80.0 | 20.0 |
| Shell Nederland Raffinaderij | | | | |
| Rotterdam | refinery | Claus | 540.0 | 71.0 |
| Texaco | | | | |
| Pernis | ref. gas | Claus | 90.0 | 44.0 |
| **NETHERLANDS ANTILLES** | | | | |
| Refineria Isla Curazao SA | | | | |
| Emmastad | refinery | Mod. Claus | 225.0 | 60.0 |
| **NORWAY** | | | | |
| Norske Shell a.s. | | | | |
| Sola | refinery | Claus | 20.0 | 4.0 |
| Rafinor a.s. | | | | |
| Mongstad | ref. gas | Claus | 13.0 | 1.0 |
| **PORTUGAL** | | | | |
| Petrogal | | | | |
| Lisbon | cat cracking gas | Claus | 30.0 | 8.3 |
| Sines | ref. gas | Claus | 100.0 | 25.4 |
| **PUERTO RICO** | | | | |
| Caribbean Petroleum Corp. | | | | |
| Yabucoa | gas oil | Claus | 60.0 | 12.0 |
| **QATAR** | | | | |
| Qatar Petrochemical Co. | | | | |
| Umm Said | acid gas | Claus | 140.0 | 112.0 |
| **SAUDI ARABIA** | | | | |
| Petromin | | | | |
| Berri | assoc. gas | Claus | 1,200.0 | 640.0 |
| Ras Tanura | refinery | . . . . | 270.0 | 71.0 |
| Shedgum | assoc. | Claus | 1,700.0 | 1,690.0 |
| Uthmaniyah | assoc. gas | Claus | 1,100.0 | 1,200.0 |
| Petromin Mobil Refining Co. | | | | |
| Yanbu | refinery | . . . . | 300.0 | 200.0 |
| Petromin Shell Refining Co. | | | | |
| Jubail | refinery | . . . . | 300.0 | 161.0 |
| **SINGAPORE** | | | | |
| Esso Singapore PvL | | | | |
| Jurong | ref. gas | Claus | 128.0 | 14.0 |
| Mobil Oil Singapore Pty. Ltd. | | | | |
| Jurong | ref. gas | . . . . | 110.0 | 31.5 |
| Shell Eastern Petroleum | | | | |
| Pulau Bukom | refinery | Claus | 300.0 | 42.0 |
| Singapore Refining Co. Pty. Ltd.* | | | | |
| Jurong | ref. gas. | Claus | 257.0 | 73.0 |
| *Singapore Petroleum Co. Pty. Ltd. has 36.7% share in design capacity. | | | | |
| **SOUTH AFRICA** | | | | |
| Mobil Refining Co. of Southern Africa Pty. Ltd. | | | | |
| Durban | ref. gas | . . . . | 70.0 | 21.0 |
| National Petroleum Refiners of South Africa Pty. Ltd. | | | | |
| Sasolburg | $H^2S$ Rich gas | Claus | 130.0 | 56.0 |
| Shell & BP South Africa Petroleum Refineries Pty. Ltd. | | | | |
| Durban | ref. gas | . . . . | 106.0 | . . . . |
| **SPAIN** | | | | |
| Petronor | | | | |
| Muskiz, Vizcaya | ref. gas | Claus | 229.0 | 83.0 |
| Repsol Petroleo | | | | |
| Cartagena | ref. gas | Claus | 27.0 | . . . . |
| La Coruña | ref. gas | Claus | 49.0 | 2.6 |
| Puertollano | ref. gas | Claus | 80.0 | 34.7 |
| Tarragona | ref. gas | Claus | 144.0 | 81.7 |
| Union Explosivos Rio Tinto SA | | | | |
| La Rábida, Huelva | ref. gas | Claus | 12.0 | 8.0 |
| **SWEDEN** | | | | |
| BP Raffinaderi Goteburg AB | | | | |
| Gothenburg | ref. gas | . . . . | 6.0 | 1.0 |
| Shell Raffinaderi BV | | | | |
| Gothenburg | refinery | Claus | 27.0 | 9.0 |
| Skandinaviska Raffinaderi AB | | | | |
| Lysekil | refinery | Claus | 225.0 | 75.0 |
| **SWITZERLAND** | | | | |
| Raffinerie de Cressier SA | | | | |
| Cressier | refinery | Claus | 20.0 | 3.0 |
| **TURKEY** | | | | |
| Tupras | | | | |
| Izmir | ref. gas | Claus | 40.0 | 18.0 |
| Izmit | ref. gas | Claus | 47.0 | 25.0 |
| Kirikkale | ref. gas | Claus | 23.2 | 7.0 |
| **UNITED KINGDOM** | | | | |
| Amoco U.K. | | | | |
| Milford Haven | refinery | Claus | 76.0 | . . . . |
| BP Oil | | | | |
| Grangemouth | ref. gas | Claus | 50.0 | 17.0 |
| Llandarcy | ref. gas | Claus | 45.0 | . . . . |
| Conoco Ltd. | | | | |
| South Humberside | ref. gas | . . . . | 50.0 | 35.0 |
| Esso Petroleum Co. Ltd. | | | | |
| Fawley | ref. gas | Claus | 270.0 | 114.0 |
| Gulf Oil Refining Ltd. | | | | |
| Milford Haven | ref. gas | . . . . | 10.0 | 4.1 |
| Lindsey Oil & Refining Ltd. | | | | |
| Killingholm, South Humberside | ref. gas | Claus | 120.0 | 60.0 |

| Company and location | Source | Type of process | – Metric tons/day –<br>Design capacity | Production |
|---|---|---|---|---|
| Mobil Oil Co. Ltd. | | | | |
| Coryton | ref. gas | .... | 200.0 | 31.5 |
| Pembroke Cracking Co. | | | | |
| Pembroke | ref. gas | Claus | 160.0 | 49.0 |
| Shell U.K. Oil | | | | |
| Shell Haven | ref. gas | Claus | 130.0 | 20.0 |
| Stanlow | ref. gas | Claus | 250.0 | 45.0 |
| **UNITED STATES** | | | | |
| American Central Gas Cos. Inc. | | | | |
| Foster, Ector County, Tex. | nat. gas | Claus | 20.0 | 10.0 |
| Amoco Oil Co. | | | | |
| Mandan, ND | ref. gas | Claus | 15.0 | 5.0 |
| Texas City, Tex. | ref. gas | Claus | 1,400.0 | 550.2 |
| Whiting, Ind. | ref. gas | Claus | 400.0 | 215.0 |
| Yorktown, Va. | ref. gas | Claus | 56.0 | 45.0 |
| Amoco Production Co. | | | | |
| Andrews County, Tex. | nat. gas | 2 bed Claus and CBA | 22.0 | 17.0 |
| Ector County, Tex. | nat. gas | 2 bed Claus | 30.0 | 27.0 |
| Eddy County, NM | nat. gas | 2 bed Claus | 36.0 | 21.0 |
| Fremont County, Wyo. | nat. gas | 2 bed Claus | 25.0 | 17.0 |
| Hockley County, Tex. | nat. gas | 2 bed Claus | 45.0 | 31.0 |
| Natrona County, Wyo. | nat. gas | Locat | 1.0 | 1.0 |
| Park County, Wyo. | nat. gas | 2 bed Claus | 62.0 | 52.0 |
| Sweetwater Co., Wyo. | nat. gas | Locat | 4.0 | 4.0 |
| Uinta County, Wyo. | nat. gas | 2 bed Claus and CBA | 1,200.0 | 1,148.0 |
| Van Zandt, Tex. | nat. gas | 3 bed Claus | 320.0 | 140.0 |
| Wood County, Tex. | nat. gas | 2 bed Claus | 40.0 | 9.0 |
| Yoakum County, Tex. | nat. gas | Locat | 8.0 | 4.0 |
| ARCO Products Co. | | | | |
| Carson, Cal. | ref. gas | Claus | 180.0 | 170.0 |
| Ferndale, Wash. | ref. gas | Claus | 180.0 | 165.0 |
| Ashland Petroleum Co. | | | | |
| Canton, Oh. | refinery | Claus | 58.0 | 28.9 |
| Catlettsburg, Ky. | refinery | Claus | 203.2 | 118.8 |
| St. Paul, Mn. | refinery | Claus | 40.0 | 14.8 |
| Birthright Gas Processing Ltd. | | | | |
| Birthright, Tex. | nat. gas | Mod. Claus | 30.0 | 5.5 |
| BP Oil Co. | | | | |
| Belle Chasse, La. | ref. gas | Claus-Scot | 50.0 | .... |
| Ferndale, Wash. | ref. gas | Claus-Scot | 19.5 | .... |
| Lima, Ohio | ref. gas | Claus | 40.0 | .... |
| Marcus Hook, Pa. | ref. gas | Claus-Scot | 160.0 | .... |
| Toledo, Ohio | ref. gas | Claus-Scot | 112.0 | .... |
| Cenex | | | | |
| Laurel, Mont. | ref. gas | Claus | 48.7 | 20.0 |
| Champlin Refining and Chemicals Inc. | | | | |
| Corpus Christi, Tex. | crude oil | Claus-Scot | 250.0 | 170.0 |
| Chevron U.S.A. Inc. | | | | |
| Carter Creek, Wyo. | nat. gas | Claus | 1015.0 | 788.0 |
| El Paso, Tex. | ref. gas | Claus | 42.0 | .... |
| El Segundo, Cal. | ref. gas | Claus | 750.0 | ... |
| Pascagoula, Miss. | ref. gas | Claus | 1,000.0 | ... |
| Philadelphia, Pa. | ref. gas | Claus | 46.0 | .... |
| Port Arthur, Tex. | ref. gas | Claus | 460.0 | .... |
| Richmond, Cal. | ref. gas | Claus | 600.0 | .... |
| Salt Lake City, Ut. | ref. gas | Claus | 12.0 | .... |
| Citgo Petroleum Corp. | | | | |
| Lake Charles, La. | ref. gas | Claus-Sulften | 405.0 | 405.0 |
| Coastal Refining & Marketing Inc. | | | | |
| Corpus Christi, Tex. | ref. gas | Claus | 85.0 | .... |
| Collet Ventures Inc. | | | | |
| Chatom, Ala. | sour gas | Claus | 140.0 | 70.0 |
| Conoco | | | | |
| Commerce City, Colo. | ref. gas | Claus | 19.0 | 16.0 |
| Westlake, La. | ref. gas | Claus | 290.0 | 195.0 |
| Crown Central Petroleum Corp. | | | | |
| Pasadena, Tex. | ref. gas | Claus | 14.3 | 13.0 |
| Diamond Shamrock R&M Inc. | | | | |
| Moore County, Tex. | ref-nat. gas | Claus | 81.3 | 22.1 |
| El Paso Natural Gas Co. | | | | |
| San Juan County, NM | nat. gas | Mod. Claus | 53.0 | .008 |
| Enron Corp. | | | | |
| Hobbs, N.M. | nat. gas | Mod. Claus | 26.4 | 12.0 |
| Barstow, Tx. | nat. gas | 2 bed Claus | 68.0 | 14.0 |
| Exxon Co. | | | | |
| Atascosa County, Tex. | nat. gas | 2 reactor split flow Claus | 20.0 | 5.1 |
| Baton Rouge, La. | refinery | Claus | 599.0 | .... |
| Baytown, Tex. | refinery | Claus | 1,123.0 | .... |
| Benicia, Cal. | refinery | Claus | 275.0 | .... |
| Crane County, Tex. | nat. gas | 2 reactor Claus | .... | 11.7 |
| Escambia County, Ala. | nat. gas | 3 reactor Claus | .... | 845.7 |
| Linden, NJ | refinery | Claus | 393.0 | .... |
| Lincoln and Sweetwater Counties, Wyo. | nat. gas | Claus | 1120.0 | 1060.0 |
| Santa Rosa County, Fla. | nat. gas | 3 reactor Claus | .... | 174.9 |
| Farmland Industries Inc. | | | | |
| Coffeyville, Kan. | ref. gas | Claus | 20.0 | 16.0 |
| Fina Oil & Chemical Co. | | | | |
| Big Spring, Tex. | ref. gas | Claus | 50.0 | 50.6 |
| Port Arthur, Tex. | ref. gas | Claus-Scot | 182.0 | 94.7 |
| Fletcher Oil & Refining Co. | | | | |
| Carson, Cal. | ref. gas | Locat | 10.0 | 3.0 |
| Frontier Oil Corp. | | | | |
| Cheyenne, Wyo. | ref. gas | Claus | 43.0 | 36.0 |
| Gary-Williams Energy Corp. | | | | |
| Fruita, Co. | ref. gas | Claus | 9.0 | 0 |
| Hawaiian Independent Refinery Inc. | | | | |
| Ewa Beach, Hi. (SRU I) | crude oil | Claus | 5.0 | 0 |
| Ewa Beach, Hi. (SRU II) | crude oil | Claus | 14.0 | 7.2 |
| Hill Petroleum Co. | | | | |
| Houston, Tex. | ref. gas | Claus | 165.0 | 30.0 |
| Texas City, Tex. | crude oil | Claus | 24.5 | 12.0 |
| Texas City, Tex. | crude oil | Scot | 1.4 | 0.6 |
| Hunt Refining Co. | | | | |
| Tuscaloosa, Ala. | ref. gas | Claus | 80.0 | 30.0 |
| Koch Hydrocarbon Co. | | | | |
| McKenzie County, ND | nat. gas | .... | 185.0 | 100.8 |
| Harmony, Miss. | nat. gas | .... | 10.0 | 3.7 |
| Koch Refining Co. | | | | |
| Corpus Christi, Tex. | ref. gas | Claus | 50.0 | 10.0 |
| Rosemount, Minn. | ref. gas | Claus | 447.0 | 400.0 |
| LaGloria Oil & Gas Co. | | | | |
| Tyler, Tex. | ref. gas | 3 bed Claus | 9.9 | 7.5 |
| LL&E Petroleum Marketing Inc. | | | | |
| Mobile, Ala. | refinery | Claus-Scot | 50.0 | 0.4 |
| Lomita Gasoline Co. | | | | |
| Long Beach, Ca. | assoc. gas | Stretford | .... | .8 |
| Lyondell Petrochemical Co. | | | | |
| Houston, Tex. | ref. gas | Claus | 355.0 | .... |
| Mapco Petroleum Inc. | | | | |
| Memphis, Tenn. | ref. gas | Claus-Scot | 39.0 | 17.3 |
| Marathon Oil Co. | | | | |
| Eddy County, NM | nat. gas | Claus | 24.0 | 18.0 |
| Hillside Co., Mich. | nat. gas | Locat | 0.5 | 0.2 |
| Park County, Wyo. | nat. gas | Claus | 4.7 | 4.0 |
| Marathon Petroleum Co. | | | | |
| Detroit, Mich. | refinery | Claus | 80.0 | 31.8 |
| Garyville, La. | refinery | Claus | 450.0 | 188.8 |
| Robinson, Ill. | refinery | Claus | 41.0 | 31.3 |
| Mesa Operating Limited Partnership—Beckham County, Ok. | nat. gas | Lo-Cat | 4.5 | 3.3 |
| Mobil Exploration & Producing U.S.—Mary Ann, Ala. | nat. gas | Claus | 229.0 | 107.0 |
| Mobil Oil Corp. | | | | |
| Beaumont, Tex. | ref. gas | Claus | 100.0 | .... |
| Chalmette, la. | ref. gas | Claus | 250.0 | .... |
| Joliet, Ill. | ref. gas | Claus | 315.0 | .... |
| Paulsboro, NJ | ref. gas | Claus | 135.0 | .... |
| Torrance, Cal. | ref. gas | Claus | 400.0 | .... |
| Montana Sulfur & Chemical Co. | | | | |
| East Billings, Mont. | ref. gas | Claus | 225.0 | 100.0 |
| Murphy Oil USA Inc. | | | | |
| Meraux, La. | ref. gas | Claus-Scot | 35.0 | 14.0 |
| Superior, Wis. | ref. gas | Claus | 14.0 | 4.0 |
| Oxy U.S.A. Inc. | | | | |
| Eutace, TX | .... | Claus-Scot | 840.0 | NR |
| Milnesand, NM | nat. gas | mod. Claus | 27.0 | 7.0 |
| Myrtle Springs, Tex. | nat. gas | Claus | 216.0 | 44.7 |
| Welch, Tex. | nat. gas | .... | 43.0 | 0.5 |
| Pennzoil Products Co. | | | | |
| Shreveport, La. | ref. gas | Claus | 11.7 | 2.2 |
| Phibro Energy Inc. | | | | |
| Houston, Tex. | ref. gas | Claus | 100.0 | 80.0 |
| Texas City, Tex. | ref. gas | Claus | 80.0 | 40.0 |
| Phillips 66 Co. | | | | |
| Artesian, NM | nat. gas | Mod-Claus | 55.9 | 21.3 |
| Borger, Tex. | refinery | Claus | 240.0 | .... |
| Chatom, Ala. | nat. gas | Claus | 193.0 | .... |
| Crane, Tex. | nat. gas | Claus | 87.9 | 20.3 |
| Eunice, NM | nat. gas | Claus | 64.0 | 27.4 |
| Fullerton, Tex. | nat. gas | Claus | 45.7 | 26.4 |
| Goldsmith, Tex. | nat. gas | Claus | 143.2 | 35.5 |
| Lee, NM | nat. gas | Claus | 26.6 | 12.8 |
| Sweeny, Tex. | refinery | Claus | 275.0 | .... |
| Rock Island Refining Corp. | | | | |
| Indianapolis, Ind. | ref. gas | Claus | 20.3 | 5.0 |

| Company and location | Source | Type of process | – Metric tons/day – Design capacity | Production |
|---|---|---|---|---|
| Shell Oil Co. | | | | |
| Anacortes, Wash. | ref. gas | Claus-Scot | 20.0 | .... |
| Deer Park, Tex. | ref. gas | Claus-Scot | 410.0 | .... |
| Martinez, Cal. | ref. gas | Claus-Scot<br>Stretford | 225.0 | .... |
| Norco, La. | ref. gas | Claus-Scot | 45.0 | .... |
| Wilmington, Cal. | ref. gas | Claus-Scot | 200.0 | .... |
| Wood River, Ill. | ref. gas | Claus-Scot | 300.0 | .... |
| Shell Western E&P Inc. | | | | |
| Bryans Mill, Tex. | nat. gas | Claus | 175.0 | .... |
| Denver Unit, Tex. | nat. gas | Claus | 4.0 | .... |
| Goodwater, Miss. | nat. gas | Claus | 50.0 | .... |
| Manistee County, Mich. | nat. gas | Claus | 25.0 | .... |
| Thomasville, Miss. | nat. gas | Claus | 1,245.0 | .... |
| Shell Smackover Ltd. | | | | |
| Eustace, Tex. | nat. gas | Claus-Scot | 660.0 | .... |
| Sid Richardson Carbon & Gasoline Co. | | | | |
| Winkler County, Tex. | nat. gas | Selectox | 20.0 | 13.9 |
| Star Enterprise | | | | |
| Convent, La. | ref. gas. | Claus | 660.0 | .... |
| Delaware City, Del. | ref. gas | Claus | 317.0 | .... |
| Port Arthur, Tex. | ref. gas | Claus | 238.0 | .... |
| Texaco Inc. | | | | |
| Franklin County, Tex.li | nat. gas | Claus | 219.0 | 50.0 |
| Freestone County (Aker), Tex. | nat. gas | Claus | 181.0 | 90.0 |
| Freestone County (Teas), Tex. | nat. gas | Claus | 138.0 | 110.0 |
| Texaco Refining & Marketing | | | | |
| Inc.—Anacortes, Wash. | ref. gas | Claus | 76.0 | .... |
| Bakersfield, Cal. | ref. gas | Claus | 40.0 | .... |
| El Dorado, Kan. | ref. gas | Claus | 159.0 | .... |
| Wilmington, Calif. | ref. gas | Claus | 279.0 | .... |
| Texas Oil & Gas Corp. | | | | |
| Coyanosa, Tex. | nat. gas | Claus | 25.0 | 4.4 |
| Pittsburg, Tex. | nat. gas | Claus | 100.0 | 71.3 |
| Teague, Tex. | nat. gas | Claus | 10.0 | 2.4 |
| Tosco | | | | |
| Martinez, Cal. | ref. gas | Claus-Scot | 180.0 | 115.0 |
| Total Petroleum Inc. | | | | |
| Alma, Mich. | sour gas | Claus | 13.2 | 12.4 |
| Ardmore, Ok. | sour gas | Claus | 18.3 | 10.0 |
| Arkansas City, Kans. | sour gas | Claus | 11.2 | 7.6 |
| Denver, Colo. | sour gas | Claus | 6.1 | 1.5 |
| Trans-Jeff Chemical Corp. | | | | |
| Tilden, Tex.-No. 1 | acid gas | Claus | 19.8 | .... |
| Tilden, Tex.-No. 2 | acid gas | Claus | 74.9 | 29.0 |
| Ultramar Refining | | | | |
| Wilmington, Cal. | crude oil | Claus | 128.0 | 124.0 |
| Unocal Corp. | | | | |
| Lemont, Ill. | ref. gas | Claus<br>Bevon<br>Stretford | 300.0 | .... |
| Lemont, Ill. | ref. gas | Claus | 100.0 | .... |
| Nederland, Tex. | ref. gas | Claus | 17.0 | .... |
| Rodeo, Cal. | ref. gas | Claus<br>Stretford | 350.0 | .... |
| Santa Maria, Cal. | ref. gas | Claus<br>Unisulf | 139.0 | .... |
| Wilmington, Cal. | ref. gas | Claus<br>Stretford | 200.0 | .... |
| Valero Refining and Marketing Co. | | | | |
| Corpus Christi, Tex. | ref. gas | Claus | 310.0 | 250.0 |
| Warren Petroleum Co. | | | | |
| Como, Hopkins County, Tex. | nat. gas | Claus | 75.0 | .... |
| Fashing, Atascosa County, Tex. | nat. gas | Claus | 36.0 | .... |
| Little Knife, Billings County, ND | nat. gas | Claus | 125.0 | .... |
| Monument, Lea County, NM | nat. gas | Claus | 32.0 | .... |
| Sand Hills, Crane County, Tex. | nat. gas | Claus | 45.0 | .... |
| Western Gas Processors, Ltd. | | | | |
| San Juan River Plant Kirkland, NM | $H^2S$ | Claus | 50.0 | 25.0 |
| **VENEZUELA** | | | | |
| Corpoven | | | | |
| El Palito, Carabobo | refinery | Claus | 36.0 | 19.0 |
| Lagoven | | | | |
| Amuay, Falcon | refinery | Claus | 600.0 | 178.0 |
| Maraven | | | | |
| Cardon, Falcon | refinery | Claus | 94.0 | 30.0 |

OGJ SPECIAL

MIDYEAR
FORECAST
REVIEW

# Crude price slump tempers midyear outlook

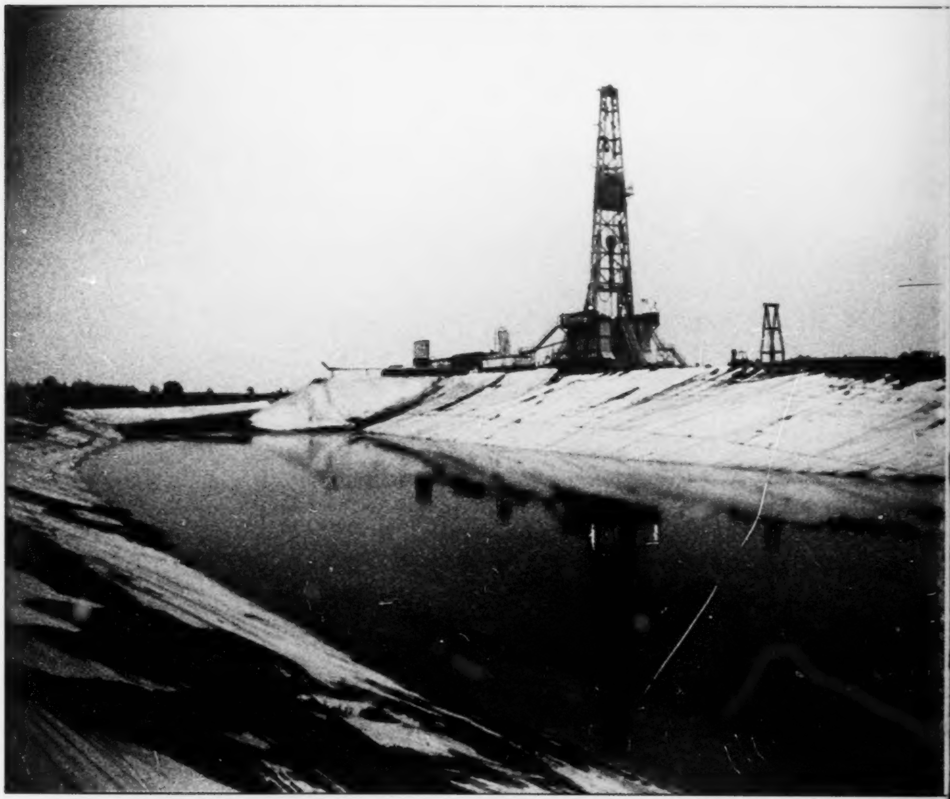
**Robert J. Beck**
Economics Editor

The rollercoaster ride for world crude prices that started in 1986 is continuing through 1990.

Once again, excess production by members of the Organization of Petroleum Exporting Countries has created a sharp drop in crude prices. The drop, however, hasn't been as severe as in past cycles.

Exploration and production activity in the U.S. and elsewhere is up from a year ago. Increased demand has boosted expectations for tight oil and natural gas supplies and higher prices. This has spurred drilling activity, particularly in the U.S., where the rig count for the first half of 1990 averaged 22% above 1989.

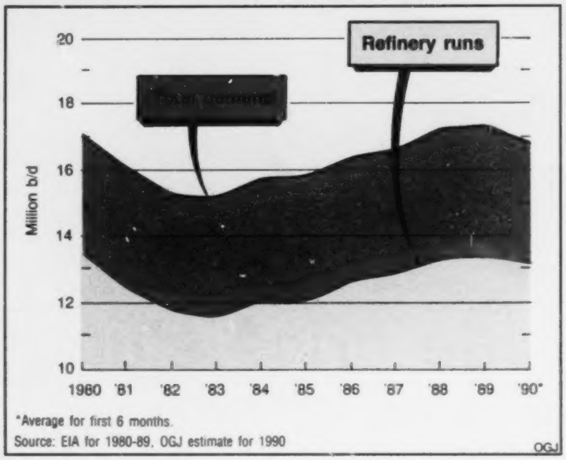
Even though demand has been moving up, there is still excess production capacity worldwide, and crude prices remain at the mercy of OPEC. The group set a production quota of 22.086 million b/d starting in 1990. Through the first 5 months of



*QUARLES RIG 25 drills the Unocal Corp. 2 Annie Bruner, completed during first half 1990 with calculated absolute open flow of 86 MMcfd, in Northeast Mayfield field, Beckham County, Okla. The well gauged 18.1 MMcfd of gas through a $^{34}/_{64}$ in. choke from 92 net ft of Siluro-Devonian Hunton pay between 24,462 ft and 24,712 ft.*

Fig. 1

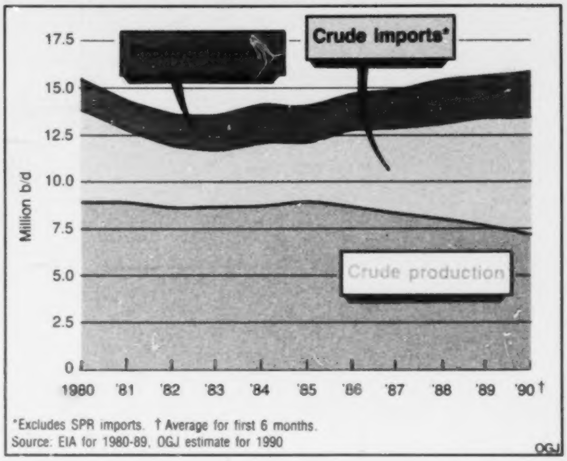
## Oil demand, refinery runs down



*Average for first 6 months.
Source: EIA for 1980-89, OGJ estimate for 1990

Fig. 2

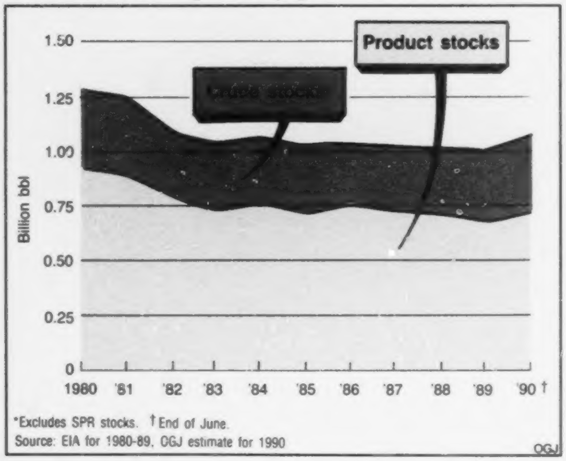
## Crude production falls, imports climb



*Excludes SPR imports. † Average for first 6 months.
Source: EIA for 1980-89, OGJ estimate for 1990

Fig. 3

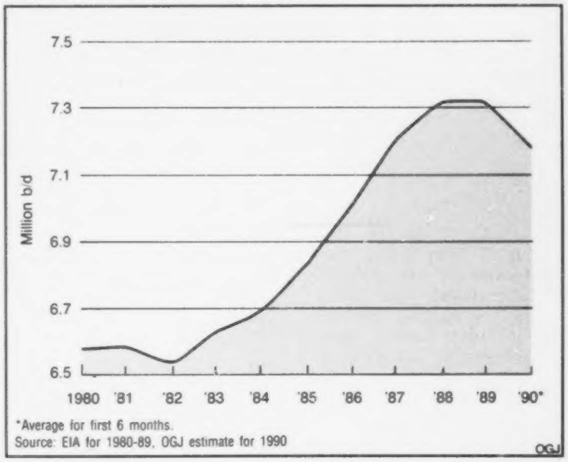
## Crude stocks up sharply



*Excludes SPR stocks. † End of June.
Source: EIA for 1980-89, OGJ estimate for 1990

Fig. 4

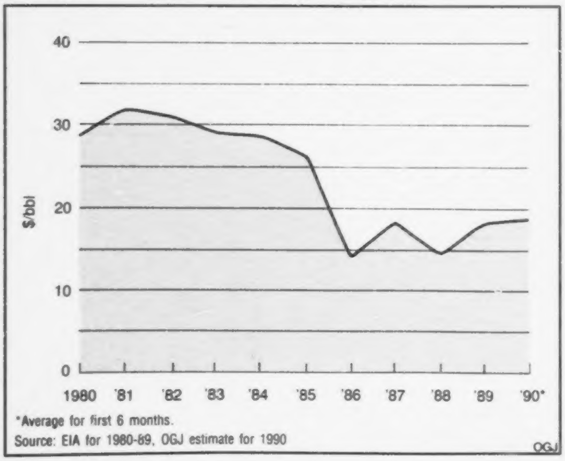
## Gasoline demand declines



*Average for first 6 months.
Source: EIA for 1980-89, OGJ estimate for 1990

Fig. 5

## Refiners' crude costs up slightly



*Average for first 6 months.
Source: EIA for 1980-89, OGJ estimate for 1990

the year, however, its output averaged an estimated 23.6 million b/d.

Much crude flowed into storage during the first half. The inflated stock levels may put more downward pressure on prices throughout the year.

In the U.S., average demand is down slightly from a year ago but remains fairly strong. This has enabled refiners to maintain product prices at levels close to a year earlier, even though crude prices are down, and to boost refining margins.

For the year, U.S. demand for petroleum products will be down slightly from a year ago due to unseasonal weather and slower economic growth. But the decline will be marginal and does not reflect any new wave of conservation or fuel switching.

Crude oil production will fall far more than demand, increasing the need for foreign oil. Total imports are expected to reach the second highest level on record in 1990. Import dependency will set a record.

Here are highlights of Oil & Gas Journal's forecast for 1990 and a midyear review of activity in the industry.

- U.S. demand for petroleum products will slip 0.2% from last year's level. This is a change from the 1.1% increase forecast at the beginning of the year (OGJ, Jan. 29, p. 49).

## U.S. demand steady in 1990, crude supply still shrinking

| | First half 1990 | | Third quarter 1990 | | Fourth quarter 1990 | | Year 1990 | |
|---|---|---|---|---|---|---|---|---|
| | Volume, 1,000 b/d | % change from 1989 | Volume, 1,000 b/d | % change from 1989 | Volume, 1,000 b/d | % change from 1989 | Volume, 1,000 b/d | % change from 1989 |
| **Demand** | | | | | | | | |
| Motor gasoline | 7,190 | −1.1 | 7,550 | 1.8 | 7,410 | 0.7 | 7,335 | 0.1 |
| Dist. 1-4 | 5,960 | −1.1 | 6,230 | 1.8 | 6,150 | 0.6 | 6,075 | — |
| Dist. 5 | 1,230 | −1.0 | 1,320 | 1.6 | 1,260 | 1.3 | 1,260 | 0.3 |
| Naphtha jet fuel | 185 | −9.3 | 215 | 2.9 | 215 | 6.4 | 200 | −2.4 |
| Dist. 1-4 | 130 | −6.5 | 150 | 5.6 | 150 | 5.6 | 140 | −0.7 |
| Dist. 5 | 55 | −15.4 | 65 | −3.0 | 65 | 8.3 | 60 | −6.3 |
| Kerosine jet fuel | 1,290 | 3.3 | 1,320 | 4.3 | 1,360 | −1.2 | 1,315 | 2.4 |
| Dist. 1-4 | 940 | 3.1 | 950 | 5.3 | 1,010 | −0.9 | 960 | 2.5 |
| Dist. 5 | 350 | 4.2 | 370 | 1.9 | 350 | −2.2 | 355 | 2.0 |
| Distillate fuel oil | 3,095 | −2.7 | 2,930 | 4.0 | 3,400 | −1.5 | 3,130 | −0.6 |
| Dist. 1-4 | 2,680 | −3.2 | 2,480 | 4.5 | 2,980 | −1.4 | 2,705 | −1.5 |
| Dist. 5 | 415 | 1.0 | 450 | 1.6 | 420 | −1.9 | 425 | — |
| Residual fuel oil | 1,290 | −10.4 | 1,250 | 9.7 | 1,450 | −1.2 | 1,320 | −3.6 |
| Dist. 1-4 | 1,040 | −11.8 | 1,000 | 10.7 | 1,160 | −0.9 | 1,060 | −4.2 |
| Dist. 5 | 250 | −3.8 | 250 | 5.9 | 290 | −2.4 | 260 | −1.1 |
| LPG and ethane | 1,540 | −9.1 | 1,500 | 2.1 | 1,860 | 2.0 | 1,610 | −3.6 |
| Dist. 1-4 | 1,480 | −9.4 | 1,450 | 1.9 | 1,810 | 1.4 | 1,555 | −3.2 |
| Dist. 5 | 60 | −1.6 | 50 | 8.7 | 50 | 28.2 | 55 | 5.8 |
| Other products | 2,250 | −1.0 | 2,570 | 0.7 | 2,450 | 14.1 | 2,380 | 2.6 |
| Dist. 1-4 | 1,930 | −0.8 | 2,230 | 0.7 | 2,130 | 13.5 | 2,055 | 2.9 |
| Dist. 5 | 320 | −2.4 | 340 | 0.9 | 320 | 18.1 | 325 | 2.8 |
| **TOTAL DOMESTIC DEMAND** | **16,840** | **−2.7** | **17,335** | **2.8** | **18,145** | **1.8** | **17,290** | **−0.3** |
| Dist. 1-4 | 14,160 | −3.0 | 14,490 | 2.9 | 15,390 | 1.7 | 14,550 | −0.5 |
| Dist. 5 | 2,680 | −0.9 | 2,845 | 1.9 | 2,755 | 2.2 | 2,740 | 0.8 |
| **EXPORTS** | **815** | **−3.6** | **840** | **4.9** | **850** | **−10.0** | **830** | **−2.4** |
| Dist. 1-4 | 375 | 5.0 | 420 | 3.4 | 410 | −13.5 | 395 | 1.6 |
| Dist. 5 | 440 | −10.0 | 420 | 6.6 | 440 | −6.4 | 435 | −5.8 |
| **TOTAL DEMAND** | **17,655** | **−2.7** | **18,175** | **2.9** | **18,995** | **1.2** | **18,120** | **−0.4** |
| Dist. 1-4 | 14,535 | −2.8 | 14,910 | 2.9 | 15,800 | 1.3 | 14,945 | −0.4 |
| Dist. 5 | 3,120 | −2.3 | 3,265 | 2.4 | 3,195 | 0.9 | 3,175 | −0.8 |
| **Supply** | | | | | | | | |
| **DOMESTIC PRODUCTION** | | | | | | | | |
| Crude & lease condensate | 7,315 | −5.6 | 7,110 | −5.4 | 7,140 | −4.1 | 7,220 | −5.2 |
| Dist. 1-4 | 4,544 | −6.3 | 4,432 | −5.3 | 4,340 | −4.6 | 4,465 | −5.8 |
| Dist. 5 | 2,771 | −4.5 | 2,678 | −5.4 | 2,800 | −3.2 | 2,755 | −4.4 |
| NGL and other hydrocarbons | 1,600 | −4.7 | 1,600 | 1.7 | 1,600 | 7.2 | 1,600 | −0.4 |
| Dist. 1-4 | 1,516 | −4.2 | 1,508 | 2.0 | 1,520 | 7.5 | 1,515 | 0.1 |
| Dist. 5 | 84 | −14.3 | 92 | −3.2 | 80 | 2.6 | 85 | −7.8 |
| Total domestic production | 8,915 | −5.5 | 8,710 | −4.1 | 8,740 | −2.2 | 8,820 | −4.3 |
| Dist. 1-4 | 6,060 | −5.8 | 5,940 | −3.6 | 5,860 | −1.7 | 5,980 | −4.3 |
| Dist. 5 | 2,855 | −4.9 | 2,770 | −5.3 | 2,880 | −3.1 | 2,840 | −4.6 |
| **IMPORTS** | | | | | | | | |
| Crude | 6,170 | 12.0 | 6,360 | 2.3 | 6,300 | 6.6 | 6,250 | 8.8 |
| Dist. 1-4 | 5,875 | 11.6 | 6,050 | 2.2 | 6,000 | 6.7 | 5,950 | 7.8 |
| Dist. 5 | 295 | 22.4 | 310 | 4.7 | 300 | 3.8 | 300 | 12.4 |
| Products & unfinished oils | 2,285 | −2.9 | 2,225 | 9.0 | 2,405 | 12.8 | 2,300 | 3.7 |
| Dist. 1-4 | 2,205 | −2.5 | 2,145 | 7.8 | 2,325 | 13.5 | 2,220 | 3.8 |
| Dist. 5 | 80 | −12.1 | 80 | 50.9 | 80 | −7.0 | 80 | 1.3 |
| Total imports | 8,455 | 7.6 | 8,585 | 4.0 | 8,705 | 8.2 | 8,550 | 6.8 |
| Dist. 1-4 | 8,080 | 7.3 | 8,195 | 3.7 | 8,325 | 8.5 | 8,170 | 6.7 |
| Dist. 5 | 375 | 13.0 | 390 | 11.7 | 380 | 1.6 | 380 | 9.8 |
| **OTHER SUPPLY** | | | | | | | | |
| Processing gain, loss, etc. | 850 | 1.3 | 900 | −2.3 | 840 | 0.2 | 860 | −0.2 |
| Dist. 1-4 | 690 | 1.3 | 755 | −2.8 | 685 | 1.0 | 705 | −0.3 |
| Dist. 5 | 160 | 1.3 | 145 | 0.7 | 155 | −3.1 | 155 | — |
| **TOTAL NEW SUPPLY** | **18,220** | **0.5** | **18,195** | **−0.4** | **18,285** | **2.6** | **18,230** | **0.8** |
| Dist. 1-4 | 14,830 | 1.3 | 14,890 | 0.3 | 14,870 | 3.9 | 14,855 | 1.7 |
| Dist. 5 | 3,390 | −2.9 | 3,305 | −3.3 | 3,415 | −2.6 | 3,375 | −2.8 |
| **STOCK CHANGE** | 565 | — | 20 | — | (710) | — | 110 | — |
| Dist. 1-4 | 295 | — | (20) | — | (930) | — | (80) | — |
| Dist. 5 | 270 | — | 40 | — | 220 | — | 200 | — |
| **CRUDE RUNS TO STILLS** | **13,280** | **0.4** | **13,880** | **0.3** | **13,480** | **1.2** | **13,480** | **0.6** |
| **TOTAL INPUT TO STILLS** | **13,420** | **0.2** | **14,020** | **0.4** | **13,620** | **1.3** | **13,620** | **0.6** |
| **TOTAL REFINERY CAPACITY** | **15,570** | **−0.7** | **15,630** | **−0.5** | **15,630** | **−0.7** | **15,600** | **−0.6** |
| **REFINERY UTILIZATION (%)** | **86.2** | **0.9** | **89.7** | **0.9** | **87.3** | **2.2** | **87.3** | **1.8** |
| **TOTAL INDUSTRY STOCKS*** | **1,103** | **6.5** | **1,105** | **1.4** | **1,040** | **3.9** | **1,040** | **3.9** |
| Refined products* | 720 | 2.1 | 725 | −4.0 | 695 | 5.3 | 695 | 5.3 |
| Crude* | 383 | 15.7 | 380 | 13.4 | 345 | 1.2 | 345 | 1.2 |
| SPR crude stocks* | 590 | 3.1 | 595 | 3.1 | 600 | 3.4 | 600 | 3.4 |

* Million bbl at end of period.

## First half crude, condensate decline again

| | First half 1990* | First half 1989 | Change, % |
|---|---|---|---|
| | —— 1,000 b/d —— | | |
| PAD District 1 | 32 | 36 | −11.1 |
| Florida | 18 | 20 | −10.0 |
| Others | 14 | 16 | −12.5 |
| PAD District 2 | 739 | 782 | − 5.5 |
| Illinois | 54 | 57 | − 5.3 |
| Kansas | 145 | 155 | − 6.5 |
| Michigan | 56 | 61 | − 8.2 |
| North Dakota | 101 | 101 | — |
| Oklahoma | 315 | 331 | − 4.8 |
| Others | 68 | 77 | −11.7 |
| PAD District 3 | 3,285 | 3,508 | − 6.4 |
| Alabama | 52 | 56 | − 7.1 |
| Arkansas | 29 | 32 | − 9.4 |
| Louisiana | 1,042 | 1,184 | −12.0 |
| Mississippi | 73 | 75 | − 2.7 |
| New Mexico | 184 | 191 | − 3.7 |
| Texas | 1,905 | 1,970 | − 3.3 |
| PAD District 4 | 488 | 523 | − 6.7 |
| Colorado | 79 | 86 | − 8.1 |
| Montana | 54 | 59 | − 8.5 |
| Utah | 75 | 78 | − 3.8 |
| Wyoming | 280 | 300 | − 6.7 |
| PAD District 5 | 2,771 | 2,903 | − 4.5 |
| Alaska | 1,781 | 1,888 | − 5.7 |
| California | 975 | 1,005 | − 3.0 |
| Others | 15 | 10 | 50.0 |
| **Total** | **7,315** | **7,752** | **− 5.6** |

*Estimated.

- U.S. crude and condensate production will drop 5.2%. In January, OGJ predicted a 3.6% decline. A key reason for the change is maintenance on the Alaskan pipeline and pumping facilities, which will further reduce the state's production. Lower 48 output will continue to slide due in part to the low level of drilling.
- Total imports will rise 6.8%, not just to make up for falling U.S. production but also to replenish product stocks, which fell in 1988 and 1989. Dependency on imported crude and products will reach an all-time high of 49.5%.
- U.S. refinery runs will rise 0.5%, and the refinery utilization rate will move up to 87.3%.
- Crude oil prices will average 5% less than 1989. Excess OPEC output will offset worldwide demand gains.
- Total industry stocks will rise 3.9%. Product stocks were close to minimum operating levels at the end of 1989 and needed to be boosted. And low crude oil prices encouraged refiners to add to crude stocks.

### The outlook

U.S. economic growth will be slower in 1990 than in the past few years, which will slow the growth in petroleum product demand.

However, demand slippage this year will mainly reflect unseasonably warm weather early in the year following the unusual cold snap at the end of 1989.

OGJ predicts average demand for all petroleum products this year at 17.29 million b/d, compared with 17.325 million b/d in 1989. First half 1990 demand is estimated at 16.84 million b/d, down 2.7% from 1989's first half. Second half demand will average 17.74 million b/d.

Total demand, including exports of crude and products, will fall 0.4% to 18.12 million b/d for the year. Exports are expected to fall 3.4% to 830,000 b/d.

## U.S. crude and products prices

| Year | Average wellhead crude price, $/bbl | Refiner's acquisition cost of crude, $/bbl | Retail motor gasoline, all types, ¢/gal | Residential heating oil, ¢/gal | Average wellhead natural gas price, $/Mcf |
|---|---|---|---|---|---|
| 1976 | 8.19 | 10.89 | 59.5 | 40.6 | 0.58 |
| 1977 | 8.57 | 11.96 | 63.1 | 46.0 | 0.79 |
| 1978 | 9.00 | 12.46 | 65.2 | 49.0 | 0.91 |
| 1979 | 12.64 | 17.72 | 88.2 | 70.4 | 1.18 |
| 1980 | 21.59 | 28.07 | 122.1 | 97.4 | 1.59 |
| 1981 | 31.77 | 35.24 | 135.3 | 119.4 | 1.98 |
| 1982 | 28.52 | 31.87 | 128.1 | 116.0 | 2.46 |
| 1983 | 26.19 | 28.99 | 122.5 | 107.8 | 2.59 |
| 1984 | 25.88 | 28.63 | 119.8 | 109.1 | 2.66 |
| 1985 | 24.09 | 26.75 | 119.6 | 105.3 | 2.51 |
| 1986 | 12.51 | 14.55 | 93.1 | 83.6 | 1.94 |
| 1987 | 15.40 | 17.90 | 95.7 | 80.3 | 1.67 |
| 1988 | 12.58 | 14.67 | 96.3 | 81.3 | 1.69 |
| 1989 | 15.85 | 17.97 | 106.0 | 90.0 | 1.71 |
| 1990E | [illegible] | [illegible] | 110.7 | 94.0 | 1.70 |

Source: 1976-1989, EIA; 1990, OGJ estimate.

Among the major product groups, demand will decline for distillates, residual fuel oil, and LPG and ethane. A large part of the decrease results from the warm weather in the first half. Increases are forecast in demand for jet fuel, motor gasoline, and other products.

Motor gasoline demand will rise on the strength of increased driving and a larger vehicle fleet, which will more than offset the continued increase in vehicle fuel efficiency.

U.S. crude oil and condensate production will average 7.22 million b/d this year. Although drilling activity is up from a year ago, it is not sufficient to stem the slide in Lower 48 production. Total output will be the lowest since 1961.

Total petroleum imports will average 8.55 million b/d, 49.5% of U.S. demand.

Crude and product stocks will rise in 1990. Refiners will increase runs to rebuild product inventories even though demand will slip.

Product stocks dipped too close to minimum operating levels in 1989, and refiners are boosting them to provide some contingency supply and avoid any temporary emergency or weather related shortages.

The increase in product stocks will help boost refinery runs this year even though demand will slip. Crude runs will gain 0.6%, and refining capacity will sink by the same amount. The result will be an increase in the capacity utilization rate to 87.3%.

Although crude prices will fall, continued strong demand will boost prices slightly for some products.

### Prices shaky

OPEC's persistent overproduction this year contrasts with last year's relative restraint.

Prices fell throughout this year's first half. The average world export price dropped from an average of $19.27/bbl in January to $13.51/bbl in June. Last year prices moved up from $15.04/bbl in January to $18.24/bbl in April.

This year's first half average crude price—$16.36/bbl—was only 1% lower than last year's average for the same period, when prices were moving in the opposite direction. This year's June average, $13.51/bbl, was down 18.3% from a year earlier.

OPEC this summer will receive some help from maintenance projects scheduled in Alaska and the North Sea, which will reduce worldwide production. Therefore, it is doubtfull that crude prices will collapse. More likely, prices will remain close to the depressed June level until demand starts picking up at the end of the third quarter. The export price will average about $15.80/bbl for the year, down 5% from 1989.

The U.S. wellhead price of crude oil averaged $17.76/bbl for the first quarter this year vs. $14.55/bbl last year. These are the latest official figures available. The price dropped to an estimated $15.47/bbl for April, compared with $17.01/bbl the year before.

The U.S. wellhead price closely tracks the world export price. OGJ projects an average U.S. wellhead price of $15/bbl for 1990, down 5.4% from 1989.

U.S. product prices have not shown the weakness exhibited by crude prices. Strong demand for many products has enabled refiners to maintain prices even though feedstock costs have been falling.

The OGJ survey of self-service unleaded motor gasoline pump prices shows the average for the first half of 1990 at $1.0455/gal, up from $1.006/gal last year. The price at the end of June was $1.0512/gal vs. $1.0702/gal a year earlier.

The first half gasoline price gain of 3.9% contrasts with the slight decline in first half average crude prices. The 1.8% June price dip contrasts with the 18% crude June-to-June price drop.

Gasoline taxes for the first half of 1990 rose to 25.02¢/gal from 24.16¢/gal in the same period last year.

Gasoline taxes are expected to move up through the year. California boosted its state gasoline tax 5¢/gal July 1. Other states may follow.

OGJ projects the pump price for all types of motor gasoline, including premium grades, to average $1.107/gal for 1990, up 4.4% from $1.06/gal for 1989. The overall price average peaked in 1981 at $1.353/gal.

Residential heating oil prices for the first 3 months of 1990 averaged $1.017/gal, up 18.4% from the first quarter last year. The sharp increase was associated with the extremely cold weather in December 1989, which depleted stocks and increased secondary stock demand for fuel oil for the first couple of months of the 1990 winter season. OGJ expects heating oil prices to average 94¢/gal for the year, up 4.4% from last year.

U.S. consumption of natural gas is expected to slip 1.1% to 18.75 tcf this year. Gas prices will remain close to their levels of the last 2 years.

OGJ expects the U.S. wellhead price for natural gas to average $1.70/Mcf in 1990, compared with $1.71/Mcf last year and $1.69/Mcf in 1988.

Gas prices peaked in 1984 at $2.66/Mcf. They fell to $1.67/Mcf in 1987 as demand weakened. Despite the fairly constant average since then, there have been sharp seasonal swings related to demand.

Gas consumption totaled 17.951 tcf in 1984. It fell to 16.221 tcf in 1986 but rebounded to 18.956 tcf last year.

### Energy demand trends

The U.S. economy is in its 8th year of continuous economic growth, a record. OGJ expects real gross national product (GNP) to increase 1.86% in 1990, the slowest growth rate of the expansion period.

Last year's growth rate was 2.98%. Growth has averaged 3.6%/year since 1982.

Energy consumption, which declined in the early 1980s, moved up 15.3% during the 8 year expansion—an average rate of increase of 1.8%/year.

Consumption has increased more rapidly in recent years because of relatively low energy prices and growth in energy intensive in-

## Energy consumption and efficiency

| Year | GNP, billion 1982 $ | Energy consumption, trillion BTU | Energy consumption per GNP $, 1,000 BTU | Oil consumption, trillion BTU | Oil consumption per GNP $, 1,000 BTU |
|---|---|---|---|---|---|
| 1929 | 711.8 | 23,756 | 33.4 | 5,521 | 7.8 |
| 1933 | 501.6 | 16,900 | 33.7 | 4,833 | 9.6 |
| 1940 | 775.0 | 23,589 | 30.4 | 7,407 | 9.6 |
| 1946 | 1,077.8 | 30,494 | 28.3 | 10,002 | 9.3 |
| 1950 | 1,206.6 | 33,992 | 28.2 | 13,489 | 11.2 |
| 1955 | 1,494.9 | 39,703 | 26.6 | 17,524 | 11.7 |
| 1960 | 1,665.3 | 44,569 | 26.8 | 20,067 | 12.1 |
| 1965 | 2,087.6 | 53,343 | 25.6 | 23,242 | 11.1 |
| 1970 | 2,416.2 | 67,143 | 27.8 | 29,537 | 12.2 |
| 1971 | 2,484.8 | 68,348 | 27.5 | 30,570 | 12.3 |
| 1972 | 2,608.5 | 71,643 | 27.5 | 32,966 | 12.6 |
| 1973 | 2,744.1 | 74,282 | 27.1 | 34,840 | 12.7 |
| 1974 | 2,729.3 | 72,543 | 26.6 | 33,455 | 12.3 |
| 1975 | 2,695.0 | 70,546 | 26.2 | 32,731 | 12.1 |
| 1976 | 2,826.7 | 74,362 | 26.3 | 35,175 | 12.4 |
| 1977 | 2,958.6 | 76,289 | 25.8 | 37,122 | 12.5 |
| 1978 | 3,115.2 | 78,088 | 25.1 | 37,965 | 12.2 |
| 1979 | 3,192.4 | 78,898 | 24.7 | 37,123 | 11.6 |
| 1980 | 3,187.1 | 75,952 | 23.8 | 34,202 | 10.7 |
| 1981 | 3,248.8 | 73,989 | 22.8 | 31,931 | 9.8 |
| 1982 | 3,166.0 | 70,840 | 22.4 | 30,232 | 9.5 |
| 1983 | 3,279.1 | 70,497 | 21.5 | 30,054 | 9.2 |
| 1984 | 3,501.4 | 74,101 | 21.2 | 31,051 | 8.9 |
| 1985 | 3,618.7 | 73,945 | 20.4 | 30,922 | 8.5 |
| 1986 | 3,717.3 | 74,237 | 20.0 | 32,196 | 8.7 |
| 1987 | 3,853.7 | 76,845 | 19.9 | 32,865 | 8.5 |
| 1988 | 4,024.4 | 80,200 | 19.9 | 34,228 | 8.5 |
| 1989 | 4,144.1 | 81,240 | 19.6 | 34,025 | 8.2 |
| 1990* | 4,221.1 | 81,690 | 19.4 | 33,940 | 8.0 |
| **Percentage change** | | | | | |
| 1929-40 | 8.9 | – 0.7 | – 9.0 | 34.2 | 23.1 |
| 1940-50 | 55.7 | 44.1 | – 7.2 | 82.1 | 16.7 |
| 1950-70 | 100.2 | 97.5 | – 1.4 | 119.0 | 8.9 |
| 1970-89 | 71.5 | 21.0 | –29.5 | 15.2 | –34.4 |

* Estimate.

## U.S. energy demand

| | 1988 – trillion BTU – | 1989 – trillion BTU – | % change 1989/88 | 1990 trillion BTU | % change 1990/89 | % of total energy 1988 | % of total energy 1989 | % of total energy 1990 |
|---|---|---|---|---|---|---|---|---|
| Oil | 34,228 | 34,025 | −0.6 | 33,940 | −0.2 | 42.7 | 41.9 | 41.6 |
| Natural gas | 18,551 | 19,506 | +5.1 | 18,300 | −1.1 | 23.1 | 24.0 | 23.6 |
| Coal | 18,846 | 18,916 | +0.4 | 19,110 | +1.0 | 23.5 | 23.3 | 23.4 |
| Nuclear | 5,661 | 5,687 | +0.5 | 5,960 | +4.8 | 7.1 | 7.0 | 7.3 |
| Hydro & other | 2,914 | 3,106 | +6.6 | 3,380 | +8.8 | 3.6 | 3.8 | 4.1 |
| **Total** | **80,200** | **81,240** | **+1.3** | **81,690** | **+0.6** | **100.0** | **100.0** | **100.0** |

Source: 1988 and 1989, EIA; 1990 OGJ estimate.

## U.S. natural gas supply and demand

| | 1987 | 1988 | 1989 | % change 1989/88 | 1990 |
|---|---|---|---|---|---|
| | Billion cu. ft. | | | | bcf |
| Production | | | | | |
| Texas | 6,126 | 6,286 | 6,207 | − 1.3 | 6,270 |
| Louisiana | 5,123 | 5,180 | 5,131 | − 0.9 | 5,170 |
| Other states | 6,100 | 6,342 | 6,605 | + 4.1 | 6,720 |
| **Total production** | **17,349** | **17,808** | **17,943** | **+ 0.8** | **18,160** |
| Imports | | | | | |
| Canada | 993 | 1,277 | 1,336 | + 4.6 | 1,500 |
| Mexico | 0 | 0 | 0. | – | 0 |
| LNG* | 0 | 17 | 42 | + 147.1 | 50 |
| **Total imports** | **993** | **1,294** | **1,378** | **+ 6.5** | **1,550** |
| Supplemental gas | 101 | 101 | 157 | + 55.4 | 160 |
| Losses, etc.† | − 1,172 | − 1,158 | − 805 | − 30.5 | − 800 |
| **Total new supply** | **17,271** | **18,045** | **18,673** | **+ 3.5** | **19,070** |
| Supply from storage | − 6 | + 57 | + 353 | – | − 250 |
| **Total supply** | **17,265** | **18,102** | **19,026** | **+ 5.1** | **18,820** |
| Exports | 54 | 74 | 70 | − 5.4 | 70 |
| **Total consumption** | **17,211** | **18,028** | **18,956** | **+ 5.1** | **18,750** |

* LNG imports for Algeria. †Extraction losses and unaccounted for gas.
Source: 1987, 1988, and 1989, EIA; 1990, OGJ estimate.

## U.S. refinery utilization

| | Crude runs | Input to distillation units | Operable capacity |
|---|---|---|---|
| | 1,000 b/d | | |
| 1980 | 13,453 | 13,788 | 18,209 |
| 1981 | 12,471 | 12,751 | 18,603 |
| 1982 | 11,766 | 12,176 | 17,445 |
| 1983 | 11,345 | 11,645 | 16,831 |
| 1984 | 12,044 | 12,335 | 16,034 |
| 1985 | 12,002 | 12,161 | 15,671 |
| 1986 | 12,716 | 12,817 | 15,467 |
| 1987 | 12,851 | 12,999 | 15,643 |
| 1988 | 13,246 | 13,447 | 15,927 |
| 1989 | 13,401 | 13,551 | 15,701 |
| 1990* | 13,480 | 13,620 | 15,600 |
| 1980-90 change | | | |
| Volume | 27 | − 168 | − 2,609 |
| Percent | 0.2 | − 1.2 | − 14.3 |
| 1989-90 change | | | |
| Volume | 79 | 69 | − 101 |
| Percent | 0.6 | 0.5 | − 0.6 |

*OGJ estimate.
Source: EIA

dustries. In the past 4 years GNP increased 13.5%, energy consumption 10%.

This year energy conservation and efficiency will increase to a degree. Energy consumption will rise only 0.6% to 81.69 quadrillion BTU (quads), while GNP increases 1.86%.

Energy consumption per unit of GNP has been falling since 1970, dropping from 27,800 BTU in 1970 to 19,600 BTU in 1989. OGJ projections show further improvement in 1990 to only 19,400 BTU/$ of GNP.

Oil energy demand is expected to slip 0.2% in 1990 to 33.94 quads. Oil's share of total energy demand will also fall, dropping to 41.6% from 41.9% last year and 42.7% in 1988.

Demand for energy from natural gas will drop 1.1% to 19.3 quads. This follows a 5.1% increase last year. The gas market share will be 23.6% vs. 24% in 1989 and 23.1% in 1988.

Energy from coal will continue to climb on the strength of increased electricity demand. Coal consumption will move up 1% to 19.11 quads. The coal market share will increase to 23.4% from 23.3% last year.

Hydroelectric and geothermal energy output will move up 8.8% in 1990 to 3.38 quads. The market share will move up to 4.1% from 3.8%. Hydro power output has been well below capacity the last couple of years because of drought in the western U.S.

Nuclear energy output will increase 4.8% this year to 5.96 quads, representing 7.3% of the market. Nuclear power output increased only 0.5% in 1989. The growth in nuclear power is expected to be slow in future years as few new units will be added.

The slowing of growth in nuclear power means the electric power industry will have to turn to other fuel sources in the future, probably coal and natural gas.

### Product demand slumps

The first half product demand slump generally reflects warm weather and price increases. The demand decline for LPG and ethane stem from the weather and petrochemical industry slowdown.

Motor gasoline demand slipped 1.1% during the first half to 7.19 million b/d. Gasoline prices averaged 3.9% higher than in first half 1989. Sluggish economic growth also played a part.

Distillate fuel oil demand was was down 2.7% from a year ago at 3.095 million b/d. Prices jumped during the cold spell in December last year and carried over into the 1990 portion of the heating season.

Demand for residual fuel oil dropped 10.4% from the first half of 1989, averaging 1.29 million b/d this year.

Starting the year, resid prices were 42% above the price at the start of 1989. Resid demand is quite sensitive to price swings since it is often in direct competition with natural gas and coal. During the first 2 months of this year consumption by electric utilities was down 34% from a year earlier.

OGJ projects a product demand turnaround in the second half, reflecting stable and relatively low product prices and some economic growth. High prices suppressed demand at the start of the year. But lower crude prices and substantial inventories will prevent any major rise in prices during the second half.

Second half demand, therefore, is expected to be up 2.3% from a year ago, averaging 17.74 million b/d, which will offset most of the first half slump.

Demand for petroleum products has recovered in recent years. Demand hit an all time high of 18.847 million b/d in 1978 and slipped to 15.231 million b/d in 1983 before starting back up.

The recovery has slowed the last couple of years. The projection for all of 1990 is about the same as the 17.283 million b/d in 1988.

Motor gasoline demand will average 7.335 million b/d this year, up 0.1% from 1989. The rate of improvement in vehicle fuel efficiency has slowed in recent years. Gasoline prices have not changed a great deal from a year ago and are well below peak prices of the early 1980s.

Gasoline demand has remained relatively constant the last 3 years. Demand in 1988 averaged 7.336 million b/d. Motor gasoline demand peaked in 1978 at 7.412 million b/d.

Distillate demand will average 3.13 million b/d this year, down 0.9%. Demand for highway diesel will continue to move up in 1990, but the increase won't be large enough to offset the decline in residential and commercial consumption of heating fuel oil. In addition to this year's warm weather, demand has been hurt by conversions to natural gas and increased heating unit efficiency.

Lower prices during the second half of the year are expected to help sustain demand for residual fuel oil at levels close to those of a year ago. However, due to the weak first half average, demand for the year will be down 3.7% at 1.32 million b/d. This mainly reflects the drop in consumption by electric utilities, which switch away from heavy fuel oil to natural gas or other fuels when the oil price gets too high.

In January 1989 the cost of heavy fuel oil delivered to steam-electric utility plants was only 3.8% higher than natural gas on a BTU basis. In January this year it was 37.4% higher than natural gas.

Demand for LPG and ethane is projected to average 1.61 million b/d in 1990, down 3.5% from the year before. Demand was lower in the first half of this year due to weaker petrochemical feedstock demand and the warm weather.

Demand for all of the other petroleum products is expected to move up 2.9% in 1990 to 2.38 million b/d. Included in this category are petrochemical feedstocks, special naphthas, lubricants, waxes, petroleum coke, asphalt and road oil, still gas, and miscellaneous products. Demand for asphalt and road oil will lead the gains.

### Gas demand dips

The 1.1% decrease projected for natural gas demand this year follows in-

## First quarter worldwide production compared

| Country | First quarter 1990 | First quarter 1989 | Change | Change, % |
|---|---|---|---|---|
| | 1,000 b/d | | | |
| **Non-OPEC** | | | | |
| U.S. | 7,460 | 7,784 | −324 | −4.2 |
| Canada | 1,464 | 1,565 | −101 | −6.5 |
| Brazil | 629 | 577 | 52 | 9.0 |
| Mexico | 2,612 | 2,620 | −8 | −0.3 |
| Other | 1,236 | 1,228 | 8 | 0.7 |
| Western Hemisphere | 13,401 | 13,774 | −373 | −2.7 |
| Norway | 1,577 | 1,399 | 178 | 12.7 |
| United Kingdom | 1,903 | 1,799 | 104 | 5.8 |
| Other | 515 | 516 | −1 | −0.2 |
| Western Europe | 3,995 | 3,714 | 281 | 7.6 |
| Egypt | 856 | 850 | 6 | 0.7 |
| Other | 925 | 913 | 12 | 1.3 |
| Africa | 1,781 | 1,763 | 18 | 1.0 |
| Oman | 640 | 610 | 30 | 4.9 |
| Other | 606 | 548 | 58 | 10.6 |
| Middle East | 1,246 | 1,158 | 88 | 7.6 |
| Australia | 557 | 484 | 73 | 15.1 |
| India | 697 | 670 | 27 | 4.0 |
| Malaysia | 600 | 582 | 18 | 3.1 |
| Other | 307 | 291 | 16 | 5.5 |
| Asia-Pacific | 2,161 | 2,027 | 134 | 6.6 |
| Total Non-OPEC | 22,584 | 22,416 | 168 | 0.7 |
| **OPEC** | 23,886 | 20,309 | 3,577 | 17.6 |
| Total Non-Communist | 46,470 | 42,725 | 3,745 | 8.8 |
| **Communist** | | | | |
| China | 2,758 | 2,720 | 38 | 1.4 |
| USSR | 11,761 | 12,329 | −568 | −4.6 |
| Other | 389 | 389 | — | — |
| Total Communist | 14,908 | 15,438 | −530 | −3.4 |
| **Total World** | **61,378** | **58,163** | **3,215** | **5.5** |

Source: Oil & Gas Journal

## OPEC production

| Country | First quarter 1990 | First quarter 1989 | Change | Change, % | OPEC quota 1,000 b/d |
|---|---|---|---|---|---|
| | 1,000 b/d | | | | |
| Algeria | 806 | 664 | 142 | 21.4 | 827 |
| Ecuador | 280 | 286 | −6 | −2.1 | 273 |
| Gabon | 262 | 188 | 74 | 39.4 | 197 |
| Indonesia | 1,267 | 1,225 | 42 | 3.4 | 1,374 |
| Iran | 3,011 | 3,028 | −17 | −0.6 | 3,140 |
| Iraq | 3,007 | 2,667 | 340 | 12.7 | 3,140 |
| Kuwait | 1,783 | 1,166 | 617 | 52.9 | 1,500 |
| Libya | 1,300 | 1,050 | 250 | 23.8 | 1,233 |
| Neutral Zone* | 391 | 391 | — | — | — |
| Nigeria | 1,750 | 1,400 | 350 | 25.0 | 1,611 |
| Qatar | 370 | 396 | −26 | −6.6 | 371 |
| Saudi Arabia | 5,569 | 4,638 | 931 | 20.1 | 5,380 |
| United Arab Emirates | 2,073 | 1,574 | 499 | 31.7 | 1,095 |
| Venezuela | 2,017 | 1,636 | 381 | 23.3 | 1,945 |
| **Total OPEC** | **23,886** | **20,309** | **3,577** | **17.6** | **22,086** |

*Shared by Kuwait and Saudi Arabia.
Source: Oil & Gas Journal.

## First half crude and products stocks*

| | 1,000 bbl †1990 | Change 1990/89, % | 1,000 bbl †1989 | Change 1989/88, % | 1,000 bbl †1988 |
|---|---|---|---|---|---|
| Motor gasoline | 218,000 | 0.6 | 216,618 | 3.1 | 210,088 |
| Naphtha jet fuel | 7,000 | 13.1 | 6,190 | – 8.2 | 6,741 |
| Kerosine jet fuel | 41,000 | 6.7 | 38,411 | – 1.0 | 38,811 |
| Distillate fuel oil | 114,000 | 14.7 | 99,419 | –10.0 | 110,418 |
| Residual fuel oil | 46,000 | 2.8 | 44,764 | 6.2 | 42,165 |
| Unfinished oils | 117,000 | 3.2 | 113,408 | – 1.7 | 115,423 |
| Other | 177,000 | – 4.9 | 186,155 | 3.9 | 179,249 |
| **Total products stocks** | **720,000** | **2.1** | **704,965** | **0.3** | **702,895** |
| Crude stocks | 383,000 | 15.7 | 331,054 | – 7.7 | 358,858 |
| **Total** | [illegible] | [illegible] | **1,036,019** | **– 2.4** | **1,061,753** |

*Excludes Strategic Petroleum Reserve. †At end of June.
Source: 1988-89, EIA; 1990, OGJ estimate.

## U.S. imports

### Sources of crude imports*

| Country | Share of total 1990, % | First quarter average 1990, 1,000 b/d | Change 1990/1989, % | Annual average 1989, 1,000 b/d | Change 1989/1988, % | Annual average 1988, 1,000 b/d |
|---|---|---|---|---|---|---|
| Algeria | 1.2 | 71 | 16.0 | 60 | 3.7 | 58 |
| Indonesia | 2.3 | 140 | –11.0 | 158 | –15.2 | 186 |
| Nigeria | 14.7 | 895 | 11.8 | 800 | 31.9 | 607 |
| Saudi Arabia | 19.0 | 1,155 | 3.5 | 1,116 | 23.7 | 902 |
| Venezuela | 9.8 | 597 | 20.6 | 495 | 12.7 | 439 |
| Other OPEC | 14.0 | 852 | 14.0 | 747 | 48.4 | 504 |
| **Total OPEC** | **61.1** | **3,710** | **9.9** | **3,376** | **25.2** | **2,696** |
| Angola | 5.1 | 311 | 11.2 | 279 | 37.5 | 203 |
| Canada | 9.6 | 586 | – 7.1 | 630 | – 7.4 | 681 |
| Colombia | 2.5 | 153 | 12.5 | 136 | 28.8 | 106 |
| Mexico | 11.7 | 713 | – 0.4 | 716 | 6.3 | 674 |
| Trinidad & Tobago | 1.4 | 83 | 12.8 | 73 | 2.9 | 71 |
| United Kingdom | 2.3 | 139 | –12.7 | 160 | –37.1 | 254 |
| Other Non-OPEC | 6.2 | 376 | –20.5 | 473 | 11.8 | 423 |
| **Total Imports** | **100.0** | **6,070** | [illegible] | **5,843** | **14.4** | **5,107** |

### Sources of refined product imports

| | | | | | | |
|---|---|---|---|---|---|---|
| Algeria | 11.0 | [illegible] | [illegible] | 209 | –13.9 | 242 |
| Saudi Arabia | 6.1 | 145 | 33.6 | 109 | –33.1 | 162 |
| Venezuela | 15.7 | 375 | – 0.8 | 378 | 6.5 | 355 |
| Other OPEC | 4.1 | 99 | 43.7 | 69 | 6.7 | 64 |
| **Total OPEC** | [illegible] | [illegible] | **15.6** | **764** | **– 7.3** | **824** |
| Brazil | 1.4 | 34 | –56.0 | 82 | –16.7 | 98 |
| Canada | 13.0 | 312 | 3.6 | 301 | – 5.6 | 319 |
| Mexico | 2.6 | 63 | 23.0 | 51 | –30.0 | 73 |
| Netherlands | 3.2 | 77 | 56.7 | 49 | –19.5 | 61 |
| Romania | 0.7 | 18 | –31.0 | 26 | –55.2 | 58 |
| Virgin Islands | 13.9 | 332 | 3.5 | 321 | 32.7 | 242 |
| Other Non-OPEC | 28.3 | 677 | 8.5 | 624 | 0.4 | 621 |
| **Total Imports** | **100.0** | [illegible] | **8.0** | **2,217** | **– 3.4** | **2,295** |

*Includes imports for the Strategic Petroleum Reserve.
Source: Energy Information Administration

creases of 4.7% in 1988 and 5.1% in 1989.

The industrial sector accounted for 50.8% of the 1.745 tcf gas demand increase of the past 2 years. But demand also moved up in the residential and commercial sectors.

This year's comparative weakness will result mainly from the early warm weather and competition from low cost fuel oil. Gas also will receive increased competition in the power market from nuclear and hydroelectric gains.

Marketed production of natural gas will increase 1.2% this year to 18.16 tcf. The gain will come despite lower demand due to the need to replenish storage drawn down last December.

Imports of natural gas are expected to increase 12.5% in 1990 to 1.55 tcf. Imports from Canada will move up 12.3% to 1.5 tcf. There will also be a small but steady supply of LNG from Algeria, growing to 50 bcf in 1990 from 42 bcf last year.

### The production slide

The decline in U.S. crude and condensate production will continue beyond 1990.

It started in early 1986 and has accelerated recently. Last year Alaskan production was hurt by the Exxon Valdez oil spill in March. This summer's pipeline and pump station maintenance projects will reduce Alaskan flow for several months.

U. S. production during the first half of 1990 averaged an estimated 7.315 million b/d, down 5.6% from the first half a year ago. Alaskan production dipped to 1.781 million b/d in the first half this year from 1.888 million b/d in the first half of 1989 and 2.031 million b/d in the same period of 1988.

Lower 48 production also dropped during the first half—5.6% to 5.534 million b/d.

Production is expected to continue to fall in the second half, averaging 7.125 million b/d. Alaskan output will average 1.75 million b/d, that of the Lower 48, 5.375 million b/d.

Alaskan production will bounce up after the maintenance projects are completed to average 1.81 million b/d in the fourth quarter. Lower 48 production will continue its slide to 5.33 million b/d.

For the year U.S. production will average 7.22 million b/d, down from 7.613 million b/d last year and 8.14 million b/d in 1988.

U.S. production reached a

## World crude prices

| Country | Type of crude and API gravity | Current price,* $/bbl | Change 6-'90 1-'90 % | In effect Jan. 1, 1990, $/bbl | Change '90/'89 % | In effect Jan. 1, 1989, $/bbl | In effect Jan. 1, 1988, $/bbl | In effect Jan. 1, 1987, $/bbl | In effect Jan. 1, 1986, $/bbl |
|---|---|---|---|---|---|---|---|---|---|
| OPEC | | | | | | | | | |
| Saudi Arabia | Arabian Light 34° | 13.50 | −26.6 | 18.40 | 39.9 | 13.15 | 17.52 | 16.15 | 28.00 |
| Abu Dhabi | Murban 39° | 14.65 | −23.1 | 19.05 | 39.1 | 13.70 | 17.92 | 15.55 | 28.15 |
| Algeria | Saharan 44° | 15.10 | −28.6 | 21.15 | 31.4 | 16.10 | 18.87 | 17.30 | 29.50 |
| Nigeria | Bonny Light 37° | 15.45 | −27.1 | 21.20 | 40.9 | 15.05 | 18.92 | 17.13 | 28.65 |
| Libya | Es Sider 37° | 14.40 | −29.4 | 20.40 | 32.5 | 15.40 | 18.52 | 16.95 | 30.15 |
| Indonesia | Minas 34° | 14.65 | −21.0 | 18.55 | 19.7 | 15.50 | 17.56 | 16.28 | 28.53 |
| Venezuela | Tia Juana 31° | 13.35 | −45.9 | 24.69 | 101.2 | 12.27 | 17.62 | 15.10 | 28.05 |
| **Total OPEC** | | **13.23** | **−29.3** | **18.72** | **40.1** | **13.36** | **16.77** | **16.10** | **27.81** |
| OTHER | | | | | | | | | |
| U.K. | Brent blend 38° | 15.10 | −28.1 | 21.00 | 32.9 | 15.80 | 18.00 | 18.25 | 26.00 |
| Norway | Ekofisk 42° | 15.20 | −26.7 | 20.75 | 30.9 | 15.85 | 17.60 | 16.86 | 26.61 |
| Mexico | Isthmus 33° | 14.05 | −29.4 | 19.90 | 37.0 | 14.53 | 14.83 | 17.00 | 26.21 |
| U.S.S.R. | Export blend 32° | 12.80 | −36.8 | 20.25 | 39.2 | 14.55 | 15.80 | 18.30 | 28.15 |
| **Total World** | | **13.47** | **−28.8** | **18.91** | **39.2** | **13.58** | **16.57** | **16.24** | **27.10** |
| U.S.† | | 13.10 | −29.2 | 18.50 | 34.2 | 13.79 | 13.64 | 13.79 | 23.96 |

* Represents estimated contract prices based on government stated prices, netback deals and spot market quotations. Prices for 1986 were official prices. † U.S. average crude oil wellhead price, current price is OGJ estimate.

Source: Energy Information Administration

recent peak of 8.971 million b/d in 1985 and averaged 9.108 million b/d during the first quarter of 1986. Production had been pushed up in the early 1980s by high rates of drilling and increased North Slope output. The drilling decline since 1986 and the recent start of the North Slope's decline hurt production now.

Alaskan output is expected to average 1.765 million b/d this year vs. 1.874 million b/d in 1989. The peak was 2.017 million b/d in 1988. Lower 48 output will dip to 5.455 million b/d from 5.739 million b/d last year.

### Imports climb

U.S. imports continue to climb, filling the gap between falling domestic output and rising demand.

Total imports, excluding crude for the Strategic Petroleum Reserve (SPR), averaged 8.455 million b/d during the first half, up 7.6% from first half 1989. Imports will average 8.645 million b/d in the second half. The year's expected 6.8% import gain follows an 8.8% jump in 1989.

The expected 8.55 million b/d import average is surpassed only by the 1977 average of 8.786 million b/d. Industry imports dipped to a recent low of only 4.949 million b/d in 1985 as a result of an increase in domestic production and a decrease in product demand, both related to the sharp run-up in crude prices.

Crude imports, excluding the SPR, are projected to increase 8% in 1990 to 6.25 million b/d quota following a 14.5% gain last year. During the first half this year they averaged 6.17 million b/d, 12% ahead of 1989's first half. Crude imports by the government for the SPR are expected to average 55,000 b/d during 1990, about the same rate as the past 2 years.

Product imports are also expected to be up in 1990—3.7% to 2.3 million b/d. During the first half product imports averaged 2.285 million b/d, down 2.9% from first half last year. Increased demand for residual fuel oil and motor gasoline in the second half are expected to boost product imports. With little excess capacity at U.S. refineries upward movement in product demand could result in increased product imports.

The leading source of crude imports during the first quarter was Saudi Arabia at 1.155 million b/d, up 3.5% from the first quarter of 1989. Crude imports from Saudi Arabia averaged 1.116 million b/d for all of last year. They were as low as 131,000 b/d in 1985.

Total U.S. crude imports from OPEC members averaged 3.71 million b/d for the first quarter, up 9.9% from the same period a year earlier. Crude imports from OPEC jumped 25.2% in 1989 to average 3.376 milion b/d for the year. Crude imports from OPEC represented 61.1% of the total crude imports in the first quarter this year. Crude imports from OPEC were only 41% of the total in 1985, averaging 1.312 million b/d.

First quarter product imports were up 8% at 2.395 million b/d. Venezuela was the leading source at 375,000 b/d, but this was down 0.8% from a year earlier. Product imports from OPEC averaged 883,000 b/d, up 15.6% from first quarter 1989.

### Stocks up sharply

Stocks of both crude and products have risen sharply in 1990 and are presently well above year ago levels.

At yearend 1989, crude stocks were at 341 million bbl and product stocks at 660 million bbl. At the end of the first half of this year crude stocks had moved up to an estimated 383 million bbl, product stocks to 720 million bbl.

Crude stocks are well above levels carried by refiners the last few years. Lower crude oil prices have encouraged refiners to carry additional inventory to meet the seasonal upswing in demand expected later this year.

Total industry stocks at yearend 1989 represented 57.9 days of supply at 1989 demand levels. Midyear 1990 stocks represented 63.8 days of supply at current demand levels. At yearend stocks are projected at 60.2 days of supply.

SPR crude stocks continue to move up and are expected to reach 600 million bbl by yearend.

### Worldwide trends

Every other year since 1986, OPEC has tested the existence of the laws of supply and demand and the free market. Results have been years of crude price collapse alternating with years of relative stability.

OPEC goes through a laborious process of setting crude production quotas that would balance supply and demand in the market and stabilize prices. Some members then proceed to produce above quota, flood the market with crude oil, and force prices down.

OPEC set its 22.086 million b/d quota in January 1990. But OPEC production averaged 23.886 million b/d during the first quarter this year. Preliminary reports indicate production close to this rate through the second quarter, when demand is traditionally below the yearly average.

OPEC has been moving its quota up with demand in recent years. The quota was only 15.8 million b/d in January 1987.

According to the U.S. Energy Information Administration, the average price of world export crude oil was $19.93/bbl the first week of 1990. The average export price for OPEC crude was $19.69/bbl. By the week of June 22 the average world export price was down to $13.09/bbl, the average OPEC export price $12.80/bbl.

The stated OPEC goal was to stabilize prices for a basket of seven world export crudes at $18/bbl. The average price for these seven crudes was $21.32/bbl the first week of 1990. It had fallen to $13.86/bbl by the week of June 22.

The major violator of the quota has been the United Arab Emirates. The U.A.E. quota is 1.095 million b/d, but its first quarter production averaged 2.073 million b/d this year.

In addition, production from the Saudi-Kuwaiti Neutral Zone apparently is not covered by the quota and averaged 391,000 b/d during the first quarter.

### The price outlook

The downward pressure on prices will probably continue through the third quarter. According to the International Energy Agency (IEA), stocks held by member countries of the Organisation for Economic Cooperation and Development are up substantially from the level at the first of the year. Total OECD stocks on land as of April 1 were 3.371 billion bbl, up 54 million bbl from January 1 and up 133 million bbl from Apr. 1, 1989.

Apr. 1 stocks represented 100 days of forward consumption vs. 92 days on Jan. 1. If refiners choose to work off some of these stocks, demand for OPEC oil will be further depressed.

Total non-Communist production was up 8.8% in the first quarter from the same period last year, an increase of 3.745 million b/d to 46.47 million b/d. Most of this was the 3.577 million b/d increase in OPEC production. Non-OPEC, non-Communist production moved up 168,000 b/d to 22.584 million b/d.

Non-OPEC output would have been up more, but increases were partly offset by drops of 324,000 b/d in the U.S. and 101,000 b/d in Canada. Production from Norway increased 178,000 b/d, and U.K. output was up 104,000 b/d.

IEA projects a 1 million b/d increase in non-Communist demand in 1990 to 53.3 million b/d. It expects only a 100,000 b/d increase in non-OPEC supply. Assuming the year's stock build-up averages 100,000 b/d, demand for OPEC crude will average 22.8 million b/d. This is up from the IEA estimate of 21.7 million b/d for OPEC output in 1989 and more than the current OPEC quota.

Second quarter demand for OPEC oil will be the lowest for the year at 20.6 million b/d. Demand for OPEC oil will then move up to 22.1 million b/d in the third quarter and 24.4 million b/d in the fourth quarter.

If demand for OPEC oil approaches IEA expectations, crude prices should begin to strengthen in the third quarter.

Lower output in the U.S. and possibly in Norway could help rescue OPEC and crude prices before then.

Expectations are that barring an economic downturn, the cyclical swing in crude prices should follow a pattern similar to that experienced in 1986 and 1988. Yet to be determined is the length of the downside of the cycle and whether the price trough will be as deep as in the past two cycles. ▪

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# Gain expected in 1990 U.S. well completions

**G. Alan Petzet**
Exploration Editor

U.S. well completions in 1990 will reach their highest level since 1987 unless balky crude prices or some unseen factor undermine second half spending.

Operators are expected to realize $70.566 billion in wellhead revenues this year, down 4.1% from the 1989 estimate. That's based on, among other things, crude oil prices averaging $15/bbl, gas prices averaging $1.70/Mcf, and production averaging 7.25 million b/d of crude and condensate and 18.16 tcf/year of gas. With less than half the year remaining, here is Oil & Gas Journal's updated look at 1990 for the U.S.:

- The rotary rig count will average 1,000 active rigs, up from last year's average of 869.
- Operators will drill about 34,320 oil wells, gas wells, and dry holes vs. the 31,700 wells forecast in January.
- Exploratory drilling will decline to an estimated 5,964 wildcats.
- Total footage drilled will be 157.87 million ft of hole; average well depth is expected to be about 4,600 ft.
- Thirteen major operators now plan to drill 3,136 U.S. wells in 1990, compared with 2,452 in the first half.

Meanwhile, drilling in western Canada will likely see 6,283 wells completed in 1990. This compares with 5,620 wells predicted last winter.

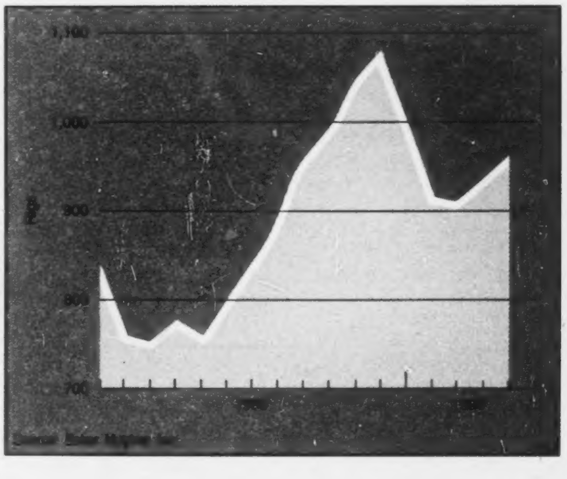
### Behind the increase

OGJ's forecast 34,320 wells is 8.3% more than its estimate for 1990 in January and 10.8% more than the 30,981 wells OGJ estimates were drilled in 1989 (OGJ, Jan. 29, p. 66). Several assumptions were used in constructing the forecast.

Drilling costs are expected to rise slightly as the number of wells drilled increases.

Average well depth is expected to increase as the percentage of gas wells to total wells rises, and each rig will drill fewer wells per year because of the greater depths. The forecast is also based on the active rig count reaching 1,150 by yearend.

**U.S. active rotary rigs**



## OGJ's revised drilling forecast for 1990—U.S. and Canada

| State district, province | First half estimates | | | | 1990 forecast | | | |
|---|---|---|---|---|---|---|---|---|
| | Total comp. | Wildcats | Field wells | Total ft (1,000) | Total comp. | wildcats | Field wells | Total ft (1,000) |
| Alabama | 566 | 70 | 496 | 2,381 | 1,100 | 136 | 964 | 4,628 |
| Alaska | 95 | 5 | 90 | 973 | 200 | 11 | 189 | 2,049 |
| Arizona | 5 | 0 | 5 | 18 | 12 | 1 | 11 | 43 |
| Arkansas | 155 | 21 | 134 | 655 | 479 | 65 | 414 | 2,025 |
| California land | 775 | 29 | 746 | 2,489 | 1,640 | 61 | 1,579 | 5,266 |
| California offshore | 13 | 0 | 13 | 100 | 18 | 0 | 18 | 138 |
| Colorado | 650 | 162 | 488 | 3,331 | 1,310 | 326 | 984 | 6,714 |
| Florida | 8 | 0 | 8 | 95 | 14 | 0 | 14 | 167 |
| Illinois | 391 | 158 | 233 | 745 | 940 | 381 | 559 | 1,792 |
| Indiana | 75 | 20 | 55 | 108 | 215 | 58 | 157 | 310 |
| Iowa | 2 | 0 | 2 | 6 | 1 | 0 | 1 | 3 |
| Kansas | 1,300 | 400 | 900 | 3,948 | 3,000 | 924 | 2,076 | 9,111 |
| Kentucky | 725 | 170 | 555 | 1,030 | 1,480 | 346 | 1,134 | 2,103 |
| Louisiana | 980 | 95 | 885 | 7,538 | 1,948 | 190 | 1,758 | 14,720 |
| North | 375 | 29 | 346 | 1,507 | 790 | 62 | 728 | 3,175 |
| South | 225 | 41 | 184 | 2,275 | 435 | 80 | 355 | 4,399 |
| Offshore | 380 | 25 | 355 | 3,756 | 723 | 48 | 675 | 7,145 |
| Michigan | 441 | 325 | 116 | 5 | 919 | 677 | 242 | 10 |
| Mississippi | 169 | 49 | 120 | 1,484 | 359 | 104 | 255 | 3,153 |
| Missouri | 3 | 0 | 3 | 11 | 5 | 0 | 5 | 18 |
| Montana | 152 | 13 | 139 | 533 | 309 | 27 | 282 | 1,083 |
| Nebraska | 56 | 30 | 26 | 276 | 110 | 59 | 51 | 541 |
| Nevada | 18 | 13 | 5 | 103 | 35 | 26 | 9 | 201 |
| New Mexico-East | 318 | 34 | 284 | 2,215 | 625 | 68 | 557 | 4,354 |
| New Mexico-West | 404 | 11 | 393 | 1,434 | 898 | 23 | 875 | 3,188 |
| New York | 110 | 5 | 105 | 296 | 240 | 10 | 230 | 647 |
| North Dakota | 106 | 50 | 56 | 868 | 227 | 107 | 120 | 1,859 |
| Ohio | 510 | 16 | 494 | 2,044 | 1,510 | 47 | 1,463 | 6,052 |
| Oklahoma | 1,609 | 106 | 1,503 | 8,182 | 3,676 | 243 | 3,433 | 18,692 |
| Oregon | 6 | 2 | 4 | 18 | 14 | 4 | 10 | 43 |
| Pennsylvania | 780 | 20 | 760 | 3,187 | 1,516 | 38 | 1,478 | 6,194 |
| South Dakota | 2 | 0 | 2 | 9 | 3 | 0 | 3 | 14 |
| Tennessee | 38 | 3 | 35 | 61 | 70 | 5 | 65 | 113 |
| Texas | 4,886 | 835 | 4,051 | 26,613 | 9,654 | 1,646 | 8,008 | 52,287 |
| Dist. 1 | 487 | 87 | 400 | 1,735 | 1,001 | 179 | 822 | 3,567 |
| Dist. 2 | 237 | 73 | 164 | 1,490 | 425 | 131 | 294 | 2,673 |
| Dist. 3 | 319 | 106 | 213 | 2,228 | 639 | 213 | 426 | 4,463 |
| Dist. 4 | 338 | 82 | 256 | 2,701 | 649 | 158 | 491 | 5,187 |
| Dist. 5 | 146 | 21 | 125 | 723 | 295 | 43 | 252 | 1,461 |
| Dist. 6 | 337 | 30 | 307 | 2,408 | 606 | 53 | 553 | 4,330 |
| Dist. 7-B | 520 | 101 | 419 | 1,463 | 1,063 | 206 | 857 | 2,991 |
| Dist. 7-C | 439 | 79 | 360 | 2,561 | 779 | 141 | 638 | 4,544 |
| Dist. 8 | 757 | 50 | 707 | 4,719 | 1,529 | 101 | 1,428 | 9,532 |
| Dist. 8-A | 422 | 64 | 358 | 2,484 | 849 | 128 | 721 | 4,997 |
| Dist. 9 | 593 | 109 | 484 | 1,979 | 1,213 | 223 | 990 | 4,048 |
| Dist. 10 | 154 | 13 | 141 | 871 | 298 | 25 | 273 | 1,685 |
| Offshore | 137 | 20 | 117 | 1,250 | 308 | 45 | 263 | 2,810 |
| Utah | 88 | 28 | 60 | 515 | 160 | 51 | 109 | 936 |
| Virginia | 5 | 1 | 4 | 24 | 11 | 1 | 10 | 52 |
| Washington | 1 | 1 | 0 | 6 | 3 | 3 | 0 | 17 |
| West Virginia | 401 | 37 | 364 | 1,681 | 777 | 71 | 706 | 3,257 |
| Wyoming | 427 | 129 | 298 | 3,089 | 842 | 255 | 587 | 6,092 |
| **Total U.S.** | **16,270** | **2,838** | **13,432** | **76,072** | **34,320** | **5,964** | **28,356** | **157,870** |
| **Western Canada** | **3,106** | **1,714** | **1,392** | **12,650** | **6,283** | **3,456** | **2,827** | **25,521** |
| Alberta | 2,314 | 1,393 | 921 | 9,784 | 4,619 | 2,781 | 1,838 | 19,529 |
| Saskatchewan | 508 | 190 | 318 | 1,552 | 1,087 | 407 | 680 | 3,321 |
| British Columbia | 219 | 113 | 106 | 1,081 | 432 | 223 | 209 | 2,132 |
| Manitoba | 56 | 9 | 47 | 174 | 120 | 20 | 100 | 374 |
| Northwest Terr. | 9 | 9 | 0 | 60 | 25 | 25 | 0 | 166 |
| Eastern Offshore | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 21 |
| Eastern land | 59 | 21 | 38 | 109 | 127 | 44 | 83 | 234 |

OGJ's estimated average rig count of 1,000 tracks closely with Baker Hughes Inc.'s most recent prognosis.

Baker Hughes expects the active rig count to average 1,005 in 1990. It estimates that 31,094 wells will be drilled for a combined 149.8 million ft of hole.

### Where it's happening

The largest concentrations of U.S. wells being drilled this year are for heavy oil in California; coalbed methane, Devonian shale, and other tax credit supported gas; and oil and gas in the Gulf of Mexico (Table 1).

About 1,640 land wells are planned in California, a majority of which will be in steamfloods.

Coalbed methane drillers are expanding operations in the San Juan basin of New Mexico and Colorado and the Black Warrior basin of Alabama.

Estimated 1990 well counts are 898 in western

New Mexico, 1,100 in Alabama, and 1,310 in Colorado.

Colorado also hosts growing coalbed methane drilling in the Piceance, Raton, and Sand Wash basins and an active Pennsylvanian Morrow oil play in Cheyenne County and adjacent counties.

Increases in the 1990 well count due to coalbed/Devonian/tight sands drilling are also evident in Kansas, Michigan, Ohio, Pennsylvania, Utah, West Virginia, and Wyoming.

Gulf of Mexico operators drilled an estimated 517 wells off Louisiana and Texas in first half 1990 and are expected to drill 1,031 wells off the two states during the full year.

Minerals Management Service figures show operators drilled 463 wildcats and 477 development wells in the entire gulf during July 16, 1989-May 1, 1990 (see table, OGJ, July 2, p. 20).

### Other hot spots

Other drilling stories find their impetus in technology as well as geology.

Horizontal drilling is still growing in the Texas Austin chalk and North Dakota Williston basin and is being used increasingly in other states.

OGJ estimates operators will drill 1,001 wells this year in Texas Dist. 1, the heart of Austin chalk country, and permits for horizontal drilling to Austin and Saratoga chalks are popping up in Texas Dist. 3 and North Louisiana.

The forecast is for drilling of 227 wells in North Dakota, more than one third of them horizontal holes to Mississippian Bakken shale (OGJ, Feb. 26, p. 53).

Drilling is far above the 1989 level in Texas Dist. 7-C, partly due to multiwell programs in Ozona and Sawyer fields and the Spraberry Trend.

West Texas infill drilling continues strong, with 1,529 wells to be drilled in Dist. 8 and 849 in Dist. 8-A this year.

Arkoma basin gas exploration and infill work are boosting drilling. OGJ forecasts 3,676 wells will be drilled in Oklahoma and 479 in Arkansas.

## The majors' report

| State, district, province | First half completions | | | Second half wells planned | | |
|---|---|---|---|---|---|---|
| | Total wells | Wildcats | Field wells | Total wells | Wildcats | Field wells |
| Alabama | 63 | 7 | 56 | 234 | 4 | 230 |
| Alaska | 44 | 3 | 41 | 58 | 7 | 51 |
| Arkansas | 1 | 1 | 0 | 11 | 5 | 6 |
| California Land | 788 | 22 | 766 | 913 | 9 | 904 |
| California Offshore | 6 | 1 | 5 | 2 | 0 | 2 |
| Colorado | 43 | 3 | 40 | 168 | 25 | 143 |
| Illinois | 55 | 0 | 55 | 58 | 6 | 52 |
| Kansas | 88 | 0 | 88 | 145 | 7 | 138 |
| Louisiana | 234 | 52 | 182 | 338 | 107 | 231 |
| North | 17 | 1 | 16 | 24 | 1 | 23 |
| South | 59 | 11 | 48 | 76 | 34 | 42 |
| Offshore | 158 | 40 | 118 | 238 | 72 | 166 |
| Michigan | 24 | 10 | 14 | 51 | 13 | 38 |
| Mississippi | 10 | 1 | 9 | 10 | 6 | 4 |
| Montana | 10 | 3 | 7 | 21 | 3 | 18 |
| Nebraska | 0 | 0 | 0 | 1 | 1 | 0 |
| Nevada | 0 | 0 | 0 | 5 | 4 | 1 |
| New Mexico—East | 50 | 3 | 47 | 96 | 4 | 92 |
| New Mexico—West | 127 | 4 | 123 | 132 | 18 | 114 |
| North Dakota | 13 | 4 | 9 | 30 | 6 | 24 |
| Oklahoma | 83 | 25 | 58 | 137 | 33 | 104 |
| Pennsylvania | 23 | 0 | 23 | 43 | 1 | 42 |
| Texas | 643 | 46 | 597 | 578 | 67 | 511 |
| Dist. 1 | 4 | 2 | 2 | 6 | 3 | 3 |
| Dist. 2 | 3 | 2 | 1 | 7 | 1 | 6 |
| Dist. 3 | 24 | 11 | 13 | 39 | 14 | 25 |
| Dist. 4 | 64 | 8 | 56 | 65 | 14 | 51 |
| Dist. 5 | 13 | 0 | 13 | 7 | 2 | 5 |
| Dist. 6 | 55 | 0 | 55 | 66 | 5 | 61 |
| Dist. 7-B | 4 | 0 | 4 | 4 | 1 | 3 |
| Dist. 7-C | 37 | 2 | 35 | 7 | 1 | 6 |
| Dist. 8 | 241 | 6 | 235 | 159 | 7 | 152 |
| Dist. 8-A | 141 | 1 | 140 | 175 | 1 | 174 |
| Dist. 9 | 8 | 0 | 8 | 3 | 3 | 0 |
| Dist. 10 | 33 | 3 | 30 | 8 | 1 | 7 |
| Offshore | 16 | 11 | 5 | 32 | 14 | 18 |
| Utah | 2 | 0 | 2 | 9 | 2 | 7 |
| West Virginia | 7 | 0 | 7 | 27 | 4 | 23 |
| Wyoming | 138 | 12 | 126 | 81 | 10 | 71 |
| **Total U.S.** | **2,452** | **197** | **2,255** | **3,148** | **342** | **2,806** |
| Western Canada | 179 | 65 | 114 | 220 | 47 | 173 |
| Alberta | 156 | 52 | 104 | 131 | 34 | 97 |
| Saskatchewan | 5 | 0 | 5 | 71 | 4 | 67 |
| Brit. Columbia | 11 | 8 | 3 | 9 | 5 | 4 |
| Manitoba | 2 | 0 | 2 | 7 | 2 | 5 |
| Northwest Terr. | 5 | 5 | 0 | 2 | 2 | 0 |

# International rig count to rise 2.2% this year

The non-Communist active rig count outside the U.S. and Canada will increase slightly in 1990.

Oil & Gas Journal forecasts that the international tally will average 940 active rigs this year, up 2.2% from the 1989 average.

The gain in the average in 1990 will be small because the count plummeted in 1989 after a strong start.

Nevertheless, the count is forecast to reach 966 rigs by yearend, 7.3% above December 1989.

Unless oil prices collapse, the international rig count will rise slowly through the rest of 1990. Increasing world demand for oil and expectations of a price rebound at yearend should help sustain drilling programs this year.

### 1990, 1989 trends

The international rig count has been building in first half 1990.

The May figure, latest available, was 937. That compared with 921 in January.

Comparing May 1990 with December 1989, Latin America was up 18 rigs, the Middle East 11, Europe seven, and Asia two. Africa idled one rig.

International rig activity dropped sharply during most of 1989. A high of 1,008 rigs in February gave way to an August count of 877, a 13% decline.

Most of the decline was in Latin America, where the rig count fell from 319 to 234. And most of that drop came in Mexico, where February's 149 rigs shrunk to 88 in August.

Brazil's total fell to 19 in August from 34 in February.

The count rebounded slightly to 900 in December 1989, but Latin America's figure fell further to 229.

Here is a rundown of highlights of international rig action comparing May 1990 with May 1989:

### Middle East

Several countries bent on increasing production capacity have swelled the region's count to 161 rigs from 139.

Largest increase in number of rigs is in Iraq, where 38 rigs are active compared with 27 a year ago.

Oman has 18 rigs running, up nine; Saudi Arabia is operating 11, up six; and Abu Dhabi has 10, a gain of five.

Syria is down four to 19, and Turkey lost two to 17.

### Africa

Algerian activity helped push the African rig count to 90 rigs, a gain of 14.

Algeria had 35 rigs running in May, up 16 from a year earlier in conjunction with a wave of exploration agreements with non-Algerian companies.

Nigeria gained three rigs to 18, while Libya lost three to 15.

### Latin America

The count is down 11 to 247 despite a large gain in Argentina.

Baker Hughes said 73 rigs were active in Argentina in May, up 17.

Growth is likely to continue in Argentina, which is deregulating its oil and gas exploration and producing industry and opening to foreign participation producing fields formerly reserved to the state oil company.

The count in Brazil is 24, down 11.

Bolivia, Colombia, Ecuador, Mexico, and Peru showed small declines.

Gains of two each were reported in Venezuela with 29 active and Trinidad with eight.

### Europe

European operators had 151 rigs running in May, down seven from May 1989.

Holland gained six rigs to 17 on the strength of Dutch North Sea action, but the U.K. lost six to 44, mostly offshore units.

Yugoslavia had 36 rigs active compared with 31 a year before.

### Asia-Pacific

The Asia-Pacific count, 288, was only one rig higher than a year earlier.

Indonesia had 54 rigs running, up seven. New production sharing countracts are expected to boost exploratory drilling there for the next several years.

Pakistan lost seven rigs for a count of eight active.

Up three each were India at 140, Malaysia 14, and Japan three.

India is gearing up for a major oil and gas production expansion that is expected to further cement the country's stance as the largest employer of rigs in the Asia-Pacific region.

### Survey of majors

Responses from major oil companies to an OGJ survey collectively show that the large companies plan decisively more drilling in the second half than in the first half.

Individual company data are confidential but show that several companies drilled a majority of their wells early in the year, perhaps opting for quick cash flow and reserve additions.

States and areas with the largest second half increase compared with first half drilling by the majors are Alabama, California land, Colorado, Kansas, and Louisiana and Texas offshore.

### Canada's outlook

Canadian drilling by all operators is expected to increase from the 1989 level, the worst since 1976.

Six major companies responding with Western Canadian figures for the first and second halves indicated a modest collective drilling increase can be expected.

Exploration is surging in British Columbia, but total drilling in the province will not likely reach 10% of drilling in Alberta.

In Alberta, May was the first month in 1990 in which more drilling permits were issued than in the same month in 1989.

Drilling in Saskatchewan, extremely light by the majors in the first half, is expected to pick up substantially in the second half. ▪

# Annual PETROCHEMICAL Report

## About this report . . .

The Journal's annual worldwide ethylene capacity and project roundup shows that the capacity for this most important building block continues to rise, increasing concerns for overcapacity during the 1990s. But an analysis of major ethylene derivatives shows that if economic conditions are healthy, some of this overcapacity pressure could be relieved by steady derivatives growth. To round out this report, another article covers the economics of ethylene production in Saudi Arabia, potentially one of the world's major olefins production areas.

# World ethylene capacity still growing

**Richard A. Corbett**
Refining/Petrochemical Editor

Despite declining prices and a softening market for ethylene worldwide, capacity growth continues on the upswing.

About 3.9 million metric tons/year (8.6 billion lb/year) of ethylene capacity came on stream during 1989, according to the Journal's survey of worldwide petrochemical plants.

Capacity rose to 54.043 million metric tons/year (119.1 billion lb/year) as of June 1, 1990, from 50.142 million metric tons/year the previous year (Table 1).

The increases are the result of healthy ethylene demand and attractive ethylene prices during the latter part of the 1980s. The booming petrochemical market of the late 1980s brought with it a rash of project announcements for ethylene capacity additions that should keep capacity rising well into the 1990s.

Concern is growing that the announced capacity additions through the mid-1990s could substantially outstrip demand, putting the industry in a serious overcapacity situation. But some of the projects have been delayed or downscaled enough to lessen the concern some.

And even though ethylene prices have fallen from about 30¢/lb to currently about 23¢/lb, higher plant efficiency means that profitability is reasonable at these lower prices.

Of course, the ethylene market depends heavily on growth in demand for ethylene derivatives, such as high and low density polyethylene, polystyrene, and polyvinyl chloride. These derivatives are the primary constituents in a wide range of plastic products that are growing as replacements for traditional raw materials for all manner of consumer and industrial products.

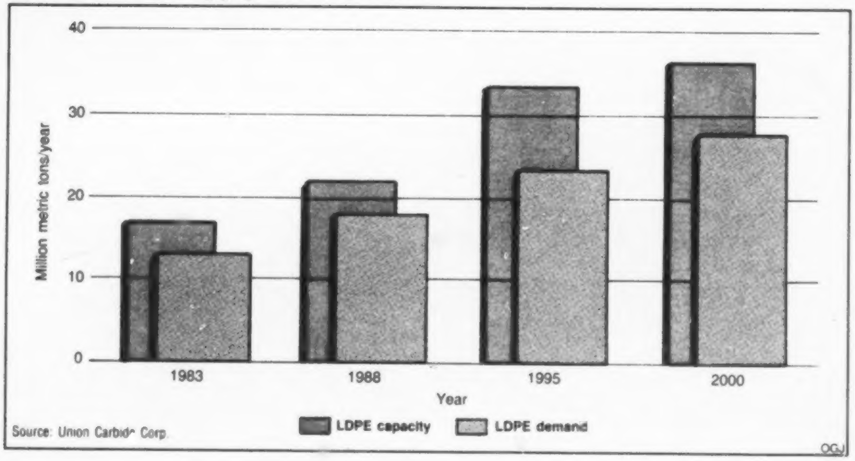
### World ethylene capacity rises

Worldwide ethylene capacity gains occurred in most regions, with the largest gains concentrated in the U.S., Latin America, and the Asia/Pacific region. The U.S. gained about 1.3 million metric tons/year as a result of Occidental Chemical Corp. increasing capacity of its Lake Charles, La., plant to 1.59 million metric tons/year total capacity (Table 2). Most other U.S. plants maintained 1989 capacity.

Mexico and Venezuela are largely responsible for the 960,000 metric ton/year ca-

Fig. 1

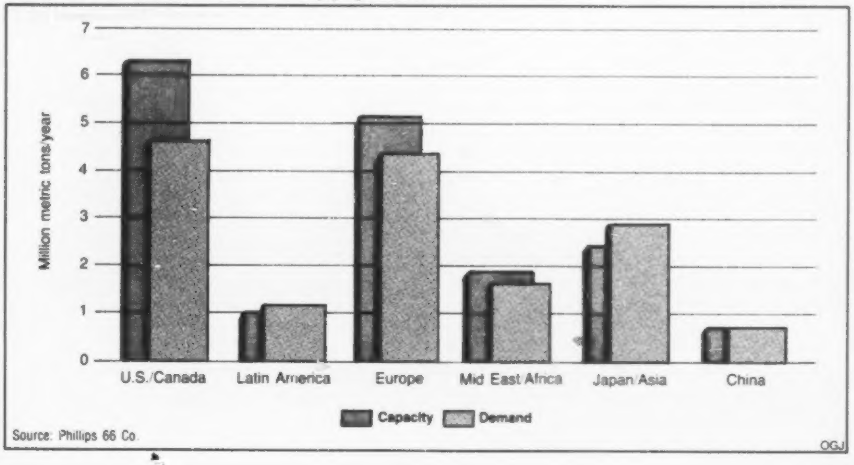
## Global LDPE supply and demand



Source: Union Carbide Corp.

Fig. 2

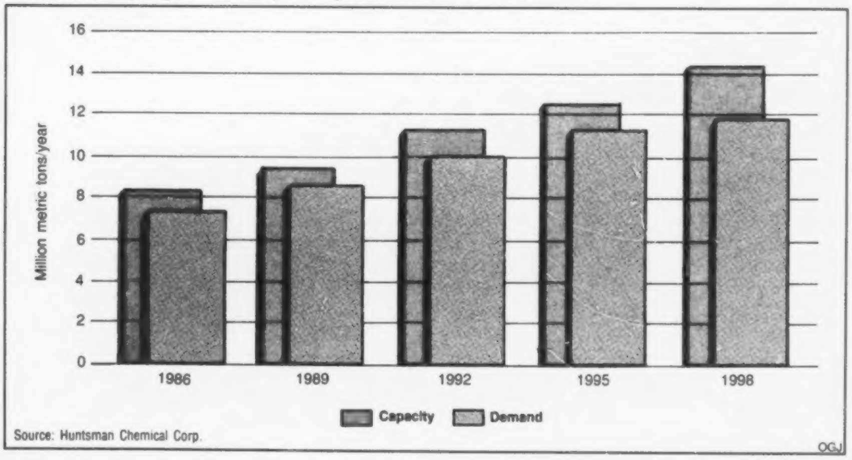
## Projected 1993 HDPE supply/demand



Source: Phillips 66 Co.

Fig. 3

## World polystyrene capacity/demand in balance



Source: Huntsman Chemical Corp.

pacity rise in the Latin American region. Pemex added 486,000 metric tons/year capacity at its Morelos, Veracruz, plant.

Pequiven, the Venezuelan state petrochemical company, reported 400,000 metric tons/year total capacity at its Anzoatequi complex, and 220,000 metric tons/year total capacity at its Zulia plant. Those capacities contrast with a total Venezuelan capacity of only 150,000 metric tons/year in 1989.

Saudi Arabia led the Mid East capacity rise with a gain of 359,000 metric tons/year. Saudi Arabia's capacity gain was equally distributed among its three plants, with Saudi Petrochemical Co.'s Al-Jubail plant capacity rising 104,000 metric tons/year, Arabian Petrochemical Co.'s Al-Jubail plant gaining 150,000 metric tons/year, and Saudi Yanbu Petrochemical Co.'s Yanbu plant gaining 105,000 metric tons/year.

The Asia/Pacific region gained 553,000 metric tons/year of ethylene capacity, all in Japan. Showa Denko, K.K. in Ohita boosted plant capacity by 264,000 metric tons/year over 1989 capacity, and Ukishima Petrochemical Co. Ltd. in Ukishima and Chiba added 219,000 metric tons/year capacity.

Smaller additions were at Tonen Petrochemical Co. Ltd. in Kawasaki (43,000 metric tons/year), Mizushima Ethylene in Mizushima (25,000 metric tons/year), and Nippon Petrochemicals in Kawasaki (2,000 metric tons/year).

In other parts of the world, Czechoslovakia reported 370,000 metric tons/year of ethylene capacity. The Chemicke Zavody CSSP plant at Litinov produces ethylene from naphtha, LPG, and gas oil feedstocks.

Even Western Europe, where ethylene overcapacity was a significant problem of the 1980s, a modest 295,000 metric tons/year increase in capacity occurred in 1989. France gained 140,000 metric tons/year capacity, with Atochem's Feyzin plant capacity rising 20,000 metric tons/year and its Gonfreville plant rising 80,000 metric tons/year. The remaining 40,000 metric tons/year rise was Shell Chimie's Berre plant.

Some 90,000 metric tons/year of ethylene capacity were added to DSM's Limburg, The Netherlands, plant, 40,000 metric tons/year was added to Ruhr Oel AG's Gelsenkerchen, West Germany, plant, and 25,000 metric tons/year were added to ICI Chemicals & Polymers Ltd.'s Wilton, U.K., plant.

### Capacity will continue up

The worldwide ethylene capacity gains scored during 1989 are just the first of many projects that will keep global ethylene capacity rising steadily through the 1990s. Although some of these projects may be delayed or scaled down (some already have since last year), most will likely come on stream by the late 1990s in response to projected demand.

Oil & Gas Journal's Worldwide Construction Reports (OGJ, Oct. 16, 1989, p. 63, and Apr. 16, 1990, p. 60) show that by 1994, about 19.8 million metric tons/year of capacity will be added worldwide (Table 3).

U.S. projects account for a large share of projected world capacity at about 4 million metric tons/year, most of that to be on stream by 1993. A large number of these projects are world scale facilities with capacities exceeding 450,000 metric tons/year (about 1 billion lb/year).

Quantum Chemical Corp. plans the largest U.S. capacity addition, 760,000 metric tons/year, with 680,600 metric tons/year at Deer Park, Tex., and 80,000 metric tons/year at Morris, Ill. But other companies rivaling that capacity boost are: Dow Chemical Co., Freeport, Tex. (680,600 metric tons/year); Phillips 66 Co. at Sweeney, Tex. (680,600 metric tons/year); and Formosa Plastics Group, Point Comfort, Tex. (680,600 metric tons/year).

Amoco Chemical Co. deferred and downsized a project at its Chocolate Bayou, Tex., plant to about 272,000 metric tons/year, scheduled for 1994 completion. The project originally would have added 680,600 metric tons/year and was scheduled for a 1993 start-up.

Table 1

## Ethylene capacity by country*

| Area | 1,000 metric tons/year<br>1988 | <br>1989 | <br>1990 |
|---|---|---|---|
| **North America** | | | |
| U.S. | 16,985 | 17,786 | 19,122 |
| Canada | 2,358 | 2,407 | 2,407 |
| **Total** | **19,343** | **20,193** | **21,529** |
| **Latin America** | | | |
| Argentina | 255 | 262 | 261 |
| Bolivia | 230 | 230 | 230 |
| Brazil | 1,502 | 1,573 | 1,581 |
| Chile | 60 | 60 | 60 |
| Colombia | 200 | 215 | 215 |
| Mexico | 932 | 932 | 1,418 |
| Puerto Rico | 413 | 413 | 413 |
| Venezuela | 150 | 150 | 630 |
| **Total** | **3,742** | **3,835** | **4,798** |
| **Western Europe** | | | |
| Austria | 320 | 320 | 320 |
| Belgium | 520 | 520 | 520 |
| Finland | 230 | 236 | 230 |
| France | 2,436 | 2,455 | 2,595 |
| West Germany | 3,790 | 3,790 | 3,830 |
| Greece | 15 | 15 | 15 |
| Italy | 1,845 | 1,845 | 1,845 |
| The Netherlands | 2,325 | 2,360 | 2,450 |
| Norway | 390 | 390 | 390 |
| Portugal | 300 | 300 | 300 |
| Spain | 988 | 960 | 980 |
| Sweden | 355 | 370 | 370 |
| Switzerland | 30 | 30 | 30 |
| U.K. | 1,945 | 1,975 | 2,000 |
| **Total** | **15,489** | **15,580** | **15,875** |
| **Asia/Pacific** | | | |
| Australia | 420 | 455 | 455 |
| India | 256 | 257 | 257 |
| Japan | 4,295 | 4,458 | 5,011 |
| South Korea | 505 | 505 | 505 |
| Singapore | 300 | 300 | 300 |
| Taiwan | 953 | 953 | 953 |
| **Total** | **6,729** | **6,928** | **7,481** |
| **Other** | | | |
| Algeria | 364 | 364 | 364 |
| Czechoslovakia | — | — | 370 |
| Hungary | 250 | 250 | 250 |
| Iran | 26 | 26 | 26 |
| Israel | 130 | 130 | 130 |
| Qatar | 280 | 300 | 300 |
| Saudi Arabia | 1,611 | 1,611 | 1,970 |
| South Africa | 220 | 320 | 345 |
| Syria | 250 | 250 | 250 |
| Turkey | 355 | 355 | 355 |
| **Total** | **3,486** | **3,606** | **4,360** |
| **World total** | **48,789** | **50,142** | **54,043** |

* As of June 1, 1990

Cain Chemical Co. has also deferred its 453,500 metric tons/year capacity increase. No deferral date has been given. No doubt, more of these projects may be downsized.

Canada is planning a significant increase in ethylene capacity of about 1.1 million metric tons/year by 1993. World-scale plants of Alberta Energy Co. and Alberta Gas Ethylene Co. (a NOVA subsidiary) will account for the increase.

Iraq has three big expansions planned for completion by 1992 that will add about 1.2 million metric tons/year to Iraq's total ethylene capacity. But the current crisis in the Mid East, and the questionable future economic health of Iraq, may put these projects on indefinite hold.

Saudi Arabia also plans an additional 1 million metric tons/year ethylene capacity by 1993. Again, the unrest in the region could delay these projects.

Another article in this special section details Saudi Arabia's ethylene capacity situation and the feedstock economics associated with ethylene production there.

China is planning about 1 million more metric tons/year of ethylene capacity, with completion scheduled before the mid-1990s. The current political situation in China, of course, could dampen expansion plans considerably.

Regionally, the Far East is planning substantial capacity increases by 1993. About 3.2 million metric tons/year of ethylene capacity are scheduled there, excluding China. Japan and Korea will see the largest increases in the Pacific Rim.

Latin America will see some 1.7 million metric tons/year come on stream by the mid-1990s, resulting from some large projects in Brazil and Mexico. However, economics are still shaky in both Brazil and Mexico.

The current Mid East crisis, however, could have a positive effect on Mexico's economic conditions if crude oil prices remain higher.

Although the planned increases in global ethylene capacity could glut the world with ethylene by the mid-1990s, deferrals and downsizing will ease that some, and steady demand for ethylene derivatives will likely make good use of the added capacity by the end of the decade.

### Derivatives growth steady

Despite fears of an ethylene overcapacity situation later during the 1990s, ethylene derivatives growth could be enough to ease, if not alleviate, the problem. But much of that growth depends on economic growth around the world, particularly in developing countries.

Substantial economic growth in the Eastern Bloc and Soviet Union could spur a rapid jump in demand for consumer products, including plastics.

But expansion of polymer plants there could lag behind demand growth.

The Far East, particularly China, is another region where substantial growth in consumer product demand could boost the need for polymer products.

### Low-density polyethylene

Steady growth is forecast for low-density polyethylene (LDPE), high-density poylethylene (HDPE), polystyrene, and polyvinyl chloride (PVC). These major consumers of ethylene were the focus of

# Installed ethylene capacity: 1990*

| Company | Location | Capacity, 1,000 metric tons/year | Feed-stock† | Coproducts | Capacity, 1,000 metric tons/year§ |
|---|---|---|---|---|---|
| **U.S.** | | | | | |
| Amoco Chemicals Co. | Chocolate Bayou, Tex. | 1,081 | E,P,N | Propylene | 445 |
| | | | | Butadiene | 93 |
| | | | | Aromatics | 82 |
| BASF Corp. | Geismar, La. | 230 | E,P | | |
| B.F. Goodrich | Calvert City, Ky. | 136 | P | Propylene | 90 |
| Cain Chemical Inc. | Corpus Christi, Tex. | 770 | LPG,N,G, Toluene | Propylene | 275 |
| | | | | Butadiene | 95 |
| | | | | Aromatics | 250 |
| | Alvin, Tex. | 500 | LPG,N,G, Toluene, Drip oil | Propylene | 305 |
| | | | | Butadiene | 60 |
| | | | | Aromatics | 340 |
| Chevron Chemical Co. | Port Arthur, Tex. | 386 | NGL,R | Propylene | 204 |
| | | | | Butadiene | 22 |
| | Baytown, Tex. | 545 | N,NGL,R | Propylene | 295 |
| | | | | Butadiene | 90 |
| Dow Chemical | Freeport, Tex. | 1,136 | E,P,B,N | Propylene | 250 |
| | | | | Butadiene | 39 |
| | Plaquemine, La. | 682 | E,P,B,N | Propylene | 75 |
| Du Pont Petrochemical | Orange, Tex. | 375 | E,P | Propylene | |
| | | | | $C_4$ | |
| El Paso Products Co. | Odessa, Tex. | 230 | E | Propylene | 100 |
| Exxon Chemical U.S.A. | Baton Rouge, La. | 590 | E,P N,G | Propylene | 400 |
| | | | | Butadiene | – |
| | | | | Aromatics | – |
| | Baytown, Tex. | 590 | N,G | Propylene | 408 |
| | | | | Butadiene | 113 |
| Fina Oil & Chem. | Groves, Tex. | 9 | R | Propylene | 30 |
| Lyondell Chemical Co. | Channelview, Tex. | 1,270 | E,P,N,G | Propylene | 839 |
| | | | | Butadiene | 216 |
| | | | | Aromatics | 374 |
| Mobil Chemical Co. | Beaumont, Tex. | 565 | NGL,N | Propylene | 145 |
| | | | | Butadiene | 27 |
| | | | | Benzene | 351 |
| | | | | Butylenes | 14 |
| | | | | Toluene | 148 |
| | Houston, Tex. | 245 | NGL,R | Propylene | 86 |
| Occidental Chemical Corp. | Lake Charles, La. | 1,590 | E,P | Propylene | 85 |
| | | | | Butadiene | 20 |
| | | | | Py gas | 30 |
| Phillips 66 Co. | Sweeney, Tex. | 1,089 | NGL | Aromatics | 566 |
| Quantum Chemical Corp.–USI Div. | Deer park, Tex. | 180 | E | | |
| | Morris, Ill. | 455 | E,P,B | Propylene | 110 |
| | | | | Butadiene | 15 |
| | | | | Py gas | 25 |
| | Clinton, Iowa | 365 | E,P | Propylene | 14 |
| | | | | Butadiene | 17 |
| | | | | Py gas | 24 |
| | | | | Fuels | 124 |
| | Tuscola, Ill. | 182 | E,P | | |
| Shell Chemical | Deer Park, Tex. | 1,315 | NGL,R | Propylene | 485 |
| | | | | Butadiene | 113 |
| | Norco, La. | 1,015 | NGL,R | Propylene | 635 |
| | | | | Butadiene | 226 |
| Sun-Olin Chemical Co. | Claymont, Del. | 109 | R | – | – |
| Sun Refining & Marketing Co. | Marcus Hook, Pa. | 86 | R | – | – |
| Texaco | Port Arthur, Tex. | 550 | E,NGL,N | Propylene | 317 |
| | | | | Butadiene | 51 |
| | Port Neches, Tex. | 115 | E,P,R | Propylene | 135 |
| Texas Eastman Co. | Longview, Tex. | 650 | E,P | Propylene | 300 |
| | | | | Aromatics & Py gas | 67 |
| | | | | Fuel oils | 6 |
| Union Carbide | Seadrift, Tex. | 562 | E,P | Propylene | 46 |
| | | | | Butadiene | – |
| | | | | Aromatics | – |
| | Taft, La. | 500 | LPG,N | Propylene | 193 |
| | | | | Butadiene | – |
| | | | | Aromatics | – |
| | Texas City, Tex. | 702 | LPG,N | Propylene | 136 |
| | | | | Butadiene | – |
| | | | | Aromatics | – |
| Vista Chemical Co. | West Lake, La. | 317 | E | Propylene | 10 |
| | | | | Butadiene | 15 |
| | | | | Aromatics | 12 |
| **U.S. Total** | | **19,122** | | | |
| **ALGERIA** | | | | | |
| Sonatrach | Arzew | 364 | LNG | – | – |
| **ARGENTINA** | | | | | |
| Duperial S.A.I.C. | San Lorenzo | 22 | N,LPG | | |
| Ipako | Ensenada | 15 | R | – | – |
| PASA Petroquimia Arg. | SAPto. Gral. San Martin | 24 | P | Butadiene | 2 |
| | | | | Aromatics | 3 |
| | | | | Fuel oils | 2 |
| Petroquimica Bahia Blanca | Bahia Blanca | 201 | E | $C_3$ | 8 |
| | | | | $C_4$ | 8 |
| | | | | Py gas | 7 |
| **Argentina Total** | | **261** | | | |
| **AUSTRALIA** | | | | | |
| Altona Petrochem. Co. Ltd. | Altona, Victoria | 170 | E,G | Propylene | 50 |
| | | | | Butadiene | 17 |
| Chemplex Australia Ltd. | | 35 | E | | – |
| ICI Australia | Botany, NSW | 250 | N,LPG | Propylene | 45 |
| | | | | Butadiene | 22 |
| | | | | Fuel oils | 14 |
| | | | | Py gas | 50 |
| **Australia total** | | **455** | | | |
| **AUSTRIA** | | | | | |
| OMV A.G. | Schwechat | 320 | B,N,G,R | Propylene | 160 |
| | | | | Butadiene | 50 |
| **BELGIUM** | | | | | |
| Petrochem S.A. | Antwerp | 520 | N | Propylene | 230 |
| | | | | Butadiene | 65 |
| | | | | Aromatics | 230 |
| | | | | Fuel oils | 85 |
| | | | | Py gas | 150 |
| **BOLIVIA** | | | | | |
| Yacimientos Petroliferos Bolivianos | La Paz | 230 | E,P | Propylene | 36 |
| | | | | Py gas | 22 |
| **BRAZIL** | | | | | |
| Brasiliera de Estireno | Cubatao | 5 | EtOH | – | – |
| Industrias Quimicas Electro Cloro | Santo Andre | 11 | EtOH | – | – |
| Copene Petroquimica | Camaracari-Bahia | 460 | N,G | Propylene | 272 |
| | | | | Butadiene | 75 |
| | | | | Py gas | 420 |
| | | | | Aromatics | ≈200 |
| Copesul | Triunfo RS | 561 | N | Propylene | 300 |
| | | | | Butadiene | 96 |
| | | | | Py gas | 215 |
| | | | | Aromatics | 385 |
| | | | | Fuel oils | 4 |
| Coperbo | Cabo | 36 | EtOH | – | – |
| Petroquimica Uniao S.A. | Santo Andre | 360 | N | Propylene | 204 |
| | | | | Py gas | 100 |
| | | | | Butadiene | 50 |
| | | | | Aromatics | 312 |
| Salgema Industrias Quimicas S.A. | Maceio-Alagoas | 100 | EtOH | – | – |
| Companhia Brasileira de Estireno | Cubatao | 48 | EtOH | – | – |
| **Brazil total** | | **1,581** | | | |
| **CANADA** | | | | | |
| Alberta Gas Ethylene Co. Ltd. | Joffre, Alta. | 1,457 | E | Propylene | 45 |
| Dow Chemical | Sarnia, Ont. | 50 | P,B,R | Propylene | – |
| Imperial (Esso Chemical) | Sarnia, Ont. | 220 | NGL | Propylene | 40 |
| | | | | Butadiene | 8 |
| | | | | Py gas | 25 |
| Petromont | Varenes, Que. | 225 | N | Propylene | – |
| Polysar Ltd. | Corunna (Sarnia) Ont. | 455 | E,N,G | Propylene | 330 |
| | | | | Butadiene | 91 |
| | | | | Aromatics | 125 |
| **Canada total** | | **2,407** | | | |
| **CHILE** | | | | | |
| Petrox S.A. | Talchuano | 60 | N | Py gas | 86 |
| | | | | Fuel oils | 9 |
| **COLOMBIA** | | | | | |
| Empresa Colombiana | Barrancabermeja | 115 | E,R | Propylene | 8 |
| | | | | Py gas | 5 |
| Poliolefinas Colombianas | Barrancabermeja | 100 | E,R | Py gas | 2 |
| | | | | Py gas | 1 |
| **Colombia total** | | **215** | | | |
| **CZECHOSLOVAKIA** | | | | | |
| Chemicke Zavody CSSP | Latinov | 370 | N,LPG,G | – | – |

# Installed ethylene capacity: 1990* (continued)

| Company | Location | Capacity, 1,000 metric tons/year | Feedstock† | Coproducts | Capacity, 1,000 metric tons/year§ |
|---|---|---|---|---|---|
| **FINLAND** | | | | | |
| Neste Oy | Porvoo | 230 | N,G,R,NGL | Propylene | 170 |
| | | | | Butadiene | 20 |
| **FRANCE** | | | | | |
| Atochem | Lavera | 260 | N, LPG | Propylene | 185 |
| | | | | Butadiene | 50 |
| | Feyzin | 135 | N, LPG | Propylene | 70 |
| | | | | Butadiene | 30 |
| | | | | Aromatics | 40 |
| | Gonfreville | 470 | N, LPG | | |
| | Lacq | 75 | E | – | – |
| BP Chimie | Lavera | 240 | LPG,N | Propylene | 155 |
| | | | | Butadiene | 50 |
| CdF Chimie | Charling & Liebonner | 420 | N,G | Propylene | 220 |
| | | | | Butadiene | 130 |
| | | | | Py gas | 55 |
| | | | | Aromatics | 360 |
| | | | | Fuel oils | 260 |
| Copenor | Dunkerque | 275 | N,G,LPG | Propylene | 120 |
| | | | | Butadiene | 75 |
| | | | | Py gas | 40 |
| | | | | Aromatics | 170 |
| | | | | Fuel oils | 175 |
| Shell Chimie | Berre | 420 | N,G,LH | Propylene | 210 |
| | | | | Butadiene | 50 |
| Esso Chimie | Notre Dame de Gravenchon | 300 | N,R | Propylene | 220 |
| | | | | Butadiene | 70 |
| | | | | Py gas | 310 |
| **France total** | | **2,595** | | | |
| **WEST GERMANY** | | | | | |
| BASF A.G | Ludwigshafen | 450 | N | Propylene | 240 |
| | | | | $C_4$ | 150 |
| | | | | Py gas | 360 |
| DMP Mineralol Petrochemie GMBH | Burghausen | 280 | N,R | Propylene | 140 |
| | | | | Butadiene | 90 |
| | | | | Aromatics | 120 |
| Deutsche Texaco A.G. | Heide | 80 | N | Propylene | 55 |
| | | | | $C_4$ | 28 |
| Erdolchemie G.m.b.H | Worringen | 740 | N | Propylene | 540 |
| | | | | Butadiene | 210 |
| | | | | Aromatics | 300 |
| | | | | Py gas | 470 |
| | | | | Fuel oils | 67 |
| Esso Chemie G.m.b.H | Cologne | 450 | N | Propylene | 240 |
| | | | | $C_4$ | 38 |
| Hüls AG | Marl | 50 | LPG | – | – |
| Rheinische Olefinwerke | Wesseling | 650 | N,G,P | Propylene | 300 |
| | | | | Butadiene | 150 |
| | | | | Py gas | 120 |
| Union Rheinische Braun-Kohlen Krafstoff A.G. | Wesseling | 440 | N,G,R LH | Propylene | 260 |
| | | | | $C_4$ | 150 |
| | | | | Py gas | 595 |
| | | | | Fuel oils | 165 |
| Ruhr Oel A.G. | Gelsenkirchen | 400 | N, LPG,G | Propylene | 265 |
| | | | | Py gas | 400 |
| | Munchmunster | 200 | N,LPG | Propylene | 150 |
| | | | | Py gas | 150 |
| Chemische Werke Huls | Marl | 50 | LPG | – | – |
| **Germany total** | | **3,830** | | | |
| **GREECE** | | | | | |
| EKO Chemicals Co. | Thessaloniki | 15 | N | Py gas | 10 |
| **HUNGARY** | | | | | |
| Tiszai Vegyi Kombinat | Leninvavos | 250 | N | Propylene | 125 |
| | | | | $C_4$ | 80 |
| | | | | Py gas | 200 |
| **INDIA** | | | | | |
| Alkali & Chemical Corp. | Rishra, W. Bengal | 12 | EtOH | – | – |
| Chemicals & Plastics India | Mettudam | 19 | EtOH | – | – |
| McDowell & Co. | Visakhapatnam | 3 | EtOH | – | – |
| India Petrochem Corp. | Baroda | 130 | N | Propylene | 81 |
| | | | | Butadiene | 22 |
| | | | | Py gas | 63 |
| National Organic Chemicals Industries Ltd. | Thane, Bombay | 63 | N | Propylene | 37 |
| | | | | Butadiene | 7 |
| | | | | Aromatics | 17 |
| Polychem Ltd | Bombay | 2 | EtOH | – | – |
| | Nira | 2 | EtOH | – | – |
| Union Carbide India Ltd. | Bombay | 22 | N | Propylene | 6 |
| | | | | Benzene | 3 |
| | | | | Aromatics | 6 |
| | | | | Fuel oils | 6 |
| Synthetics & Chemicals Ltd. | | 4 | EtOH | – | – |
| **India total** | | **257** | | | |
| **IRAN** | | | | | |
| Abadan Petrochemical | Abadan | 26 | R | Propylene | 15 |
| **ISRAEL** | | | | | |
| Oil Ref. Ltd. | Haifa Bay | 130 | N,R,LPG | – | – |
| **ITALY** | | | | | |
| Enichem | Gela | 310 | E,N | Propylene | 160 |
| | | | | Butadiene | 40 |
| | | | | Py gas | 280 |
| | | | | Aromatics | 150 |
| | | | | Fuel oils | 55 |
| | Priolo | 215 | N | Propylene | 150 |
| | Bindisi | 130 | N | Propylene | 85 |
| | | | | Butadiene | 120 |
| | Porto Tores | 240 | N | Propylene | 121 |
| | | | | Butadiene | 50 |
| ICAM | Priolo | 600 | N,G | Propylene | 350 |
| Montedipe | Porto Marghera | 350 | N | Propylene | 180 |
| **Italy total** | | **1,845** | | | |
| **JAPAN** | | | | | |
| Idemitsu Petrochem Co. Inc. | Tokuyama | 380 | N | Propylene | 220 |
| Maruzen Petrochem Co. Inc. | Goi | 373 | N | Propylene | 220 |
| | | | | Butadiene | 55 |
| | | | | Aromatics | 240 |
| Mitsubishi Petrochemical Co. Inc. | Kashima | 387 | N,LPG | – | – |
| | Yokkaichi | 254 | N,LPG | – | – |
| Mizushima-Ethylene | Mizushima | 400 | N,LPG | Propylene | 239 |
| Nippon Petrochemicals | Kawasaki | 190 | N,LPG | Aromatics | 118 |
| | | | | Butadiene | 60 |
| Osaka Petrochemicals Industries | Osaka | 332 | N,B | Propylene | 220 |
| | | | | Aromatics | 130 |
| | | | | Butadiene | 53 |
| | | | | Py gas | 280 |
| | | | | Fuel oils | 30 |
| Sanyo Ethylene Co. | Mizushima | 390 | N | Propylene | 254 |
| Shin Daikyowa Petrochemical Co. | Yokkaichi | 300 | N | Propylene | 156 |
| | | | | Butadiene | 44 |
| | | | | Py gas | 220 |
| | | | | Aromatics | 124 |
| Showa Denko. K.K. | Ohita & Kawasaki | 584 | N,LPG | Propylene | 251 |
| | | | | Butadiene | 97 |
| | | | | Py gas | 357 |
| | | | | Fuel oils | 131 |
| Sumitomo Chem. Co. Ltd. | Chiba | 358 | N,LPG | Propylene | 255 |
| | Nihama | 139 | N | Propylene | 123 |
| Tonen Petrochemical Co. Ltd. | Kawasaki | 393 | N | Propylene | 270 |
| | | | | Butadiene | 100 |
| | | | | Py gas | 170 |
| | | | | Aromatics | 150 |
| | | | | Fuel oils | 32 |
| Ukishima Petrochem Co. Ltd. | Ukishima & Chiba | 531 | N,LPG | Propylene | 172 |
| **Japan total** | | **5,011** | | | |
| **KOREA** | | | | | |
| Daelim Industrial | Yeochun | 350 | N,G,LPG | Propylene | – |
| | | | | Aromatics | – |
| Yukong Ltd. (formerly Korean Oil) | Ulsan | 155 | N | Propylene | – |
| | | | | Butadiene | 24 |
| | | | | Aromatics | 70 |
| | | | | Fuel oils | 18 |
| | | | | Py gas | 128 |
| **Korea total** | | **505** | | | |
| **MEXICO** | | | | | |
| Petroleos Mexicanos | La Cangrejera | 500 | | Propylene | 27 |
| | Pajaritos | 209 | E | | |
| | Poza Rica | 182 | E | Propylene | 9 |
| | Reynosa | 27 | LH | | |
| | Morelos | 500 | E | Propylene | 27 |
| **Mexico total** | | **1,418** | | | |

Table 2 (continued)

## Installed ethylene capacity: 1990* (continued)

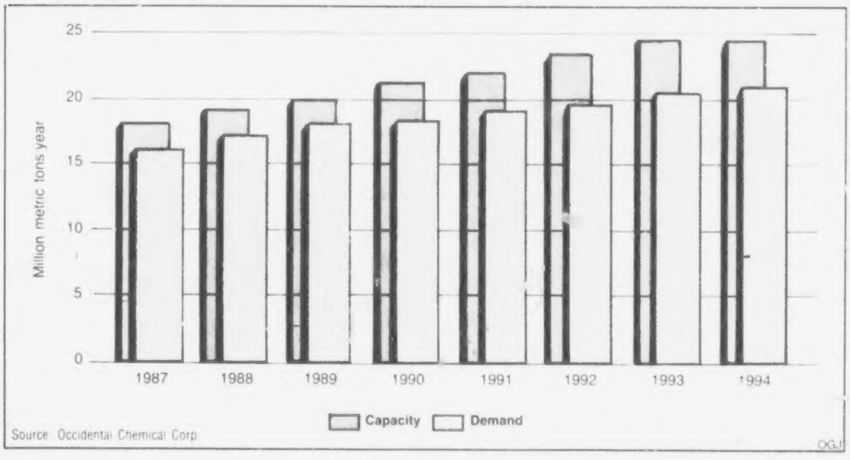
| Company | Location | Capacity, 1,000 metric tons/year | Feed-stock† | Coproducts | Capacity, 1,000 metric tons/year§ |
|---|---|---|---|---|---|
| **THE NETHERLANDS** | | | | | |
| Dow Chemical Europe | Terneuzan | 960 | N | Propylene | 450 |
| | | | | Benzene | 600 |
| | | | | Butadiene | 150 |
| DSM | Limburg | 940 | N | | |
| Shell Nederland Chemie BV | Moerdijk | 550 | N,G,LPG | Propylene | 300 |
| | | | | Butadiene | 115 |
| | | | | Py gas | 25 |
| **The Netherlands total** | | **2,450** | | | |
| **NORWAY** | | | | | |
| I/S Noretyl | Rafnes | 390 | NGL | Propylene | 70 |
| **PORTUGAL** | | | | | |
| Companhia Nacional de Peroquimice | Sines | 300 | LPG,N | Propylene | 150 |
| | | | | Butadiene | 40 |
| | | | | Py gas | 220 |
| | | | | Fuel oils | 36 |
| **PUERTO RICO** | | | | | |
| Union Carbide Caribe Inc. | Ponce | 413 | N,LPG | Propylene | 227 |
| **QATAR** | | | | | |
| Qatar Petrochemical | Umm Said | 300 | E | Propylene | 6 |
| | | | | Butadiene | 5 |
| | | | | Py gas | 15 |
| **SAUDI ARABIA** | | | | | |
| Saudi Petrochemical Co. | Al-Jubail | 760 | E | – | – |
| Arabian Petrochemical Co. | Al-Jubail | 650 | E | – | – |
| Saudi Yanbu Petrochem. Co. | Al-Jubail | 560 | E | – | – |
| **Saudi Arabia total** | | **1,970** | | | |
| **SINGAPORE** | | | | | |
| Singapore Petro-Chemical | Singapore | 300 | LPG,N | Propylene | – |
| **SOUTH AFRICA** | | | | | |
| Sasol Ltd. | Sasolburg | 345 | Syn. gas | Propylene | 150 |
| **SPAIN** | | | | | |
| Dow | Tarragona | 350 | N | Propylene | 130 |
| | | | | Butadiene | 50 |
| | | | | Py gas | 300 |
| Repsol Petroleo S.A. | Puertollano | 240 | N,R | Propylene | 180 |
| | | 390 | LPG,N | Propylene | 180 |
| **Spain total** | | **980** | | | |
| **SWEDEN** | | | | | |
| Statoil Petrochemie A/B | Stenungsund | 370 | N,P | Propylene | 180 |
| | | | | Py gas | 130 |
| | | | | Fuel oils | 40 |
| **SWITZERLAND** | | | | | |
| Lonza, A.G. | Visp | 30 | N,LPG | Acetylene | |
| **SYRIA** | | | | | |
| General Fertilizer | Katteneh | 250 | E | – | – |
| **TAIWAN** | | | | | |
| Chinese Petro. Corp. | Koahsiung | 909 | N,G | Propylene | 477 |
| | | | | Butadiene | 128 |
| China Petrochemical Development Corp. | Toufen | 54 | E | – | – |
| **Taiwan total** | | **963** | | | |
| **TURKEY** | | | | | |
| Yarpet Yarimea Petrokimya A.S. | Izmit | 55 | N | Propylene | 40 |
| | | | | Py gas | 6 |
| | | | | Fuel oils | 7 |
| | Izmir | 300 | N | Propylene | 136 |
| | | | | $C_4$ | 80 |
| | | | | Py gas | 250 |
| | | | | Fuel oils | 38 |
| **Turkey total** | | **355** | | | |
| **UNITED KINGDOM** | | | | | |
| BP Chemicals | Baglan Bay | 350 | N | Propylene | 200 |
| | | | | Butadiene | 60 |
| | Grangemouth | 270 | | Propylene | 180 |
| | | | | Butadiene | 48 |
| ICI Chemicals & Polymers Ltd. | Wilton | 755 | N,LPG | Propylene | 350 |
| | | | | Butadiene | 120 |
| Exxon Chemical Olefins Inc. | Fawley | 105 | N,G | Propylene | 100 |
| | | | | Butadiene | 60 |
| | Fife | 500 | E | | |
| **U.K. total** | | **2,000** | | | |
| **VENEZUELA** | | | | | |
| Pequiven | Anzoategui | 400 | E | – | – |
| | Zulia | 220 | E | Propylene | 73 |
| **Venezuela total** | | **320** | | | |
| **WORLD TOTAL** | | **54,843** | | | |

*(As of June 1, 1990)

†Key: E = Ethane, P = Propane, [illegible] = Butane, R = Refinery streams, N = Naphtha, G = Gas oil, LH = Light hydrocarbons, NGL = Natural gas liquids (ethane, propane, butane), LPG = Liquefied petroleum gas (propane, butane), EtOH = Ethanol

§ Coproduct production is only estimated or design quality. Actual production can vary widely depending on feedstock slate, severity, etc.

### Steady growth seen for world PVC demand



Source: Occidental Chemical Corp.

analysis at the 1990 DeWitt Petrochemical Review earlier this year in Houston.[1-4] LDPE consumption grew to about 18.5 million metric tons/year in 1989 from about 12.3 million metric tons in 1983, according to Donald Ryan of Union Carbide Corp., Danbury, Conn.[1] That growth rate cannot be maintained through the 1990s, he says, but could be as high as 4%/year (Fig. 1).

Even at that growth, some 28.6 million metric tons could be consumed by the year 2000. Capacity could likely run close to 37 million metric tons/year, according to Ryan.

Western Europe and U.S. LDPE growth should be about the same, growing at

Table 3

## Some of the major ethylene projects planned*

| Country/company | Capacity expansion, 1,000 metric tons/year | Estimated start date |
|---|---|---|
| **U.S.** | | |
| Amoco Chemical Co. | 272.0 | 1994 |
| Cain Chemical Co. | 453.5 | 1993 |
| Chevron Chemical Co. | 90.7 | 1990 |
| Dow Chemical Co. | 680.6 | 1992 |
| Exxon Chemical Co. | 453.5 | 1990 |
| Formosa Plastics Group | 680.6 | 1992 |
| Mobil Chemical Co. | 453.5 | — |
| Phillips 66 Co. | 680.6 | 1991 |
| Quantum Chemical Corp. | 760.0 | 1991 |
| Vista Chemical Co. | 181.4 | 1990 |
| Westlake Petrochemicals Corp. | 453.5 | 1991 |
| **CANADA** | | |
| Alberta Energy Co. | 500.0 | 1993 |
| Alberta Gas Ethylene Co. | 680.0 | 1992 |
| **BELGIUM** | | |
| Exxon Chemical | 450.0 | 1991 |
| Finaneste | 450.0 | 1990 |
| **BULGARIA** | | |
| Neftochim | 150.0 | 1990 |
| **FRANCE** | | |
| Atochem | 80.0 | 1990 |
| Naphthachimie | 150.0 | 1992 |
| DMP Minerol | 38.0 | 1990 |
| **WEST GERMANY** | | |
| Rheinische Olefinwerke | 120.0 | 1991 |
| Union Rheinische | 40.0 | 1991 |
| **HUNGARY** | | |
| Tiszai Vegyi Kombinant | 50.0 | 1990 |
| **ITALY** | | |
| Enichem | 240.0 | 1990 |
| Enimont | 400.0 | ? |
| **THE NETHERLANDS** | | |
| Dow Chemical | 200.0 | 1990 |
| **SPAIN** | | |
| Dow Chemical | 60.0 | 1990 |
| Repsol Petroleo | 35.0 | 1990 |
| **SWEDEN** | | |
| Nobel Chematur | 40.0 | ? |
| Statoil Petrokemi | 30.0 | 1990 |
| **UNITED KINGDOM** | | |
| BP Chemical Ltd. | 380.0 | ? |
| Exxon Chemical Ltd. | 100.0 | 1990 |
| **ARGENTINA** | | |
| Petroquimica Bahia Blanca | 200.0 | 1992 |
| **BRAZIL** | | |
| Copene | 450.0 | 1991 |
| Petroquimica Uniao | 540.0 | 1990 |
| **MEXICO** | | |
| Pemex | 500.0 | 1991 |
| **VENEZUELA** | | |
| Pequiven | 350 | ? |
| **AUSTRALIA** | | |
| Altona Petrochemical Co. | 140.0 | 1992 |
| **CHINA** | | |
| Sinopec | 640.0 | 1991 |
| Chia Tai Co. | 250.0 | ? |
| Zhong Yuan Petrochemical United | 140.0 | 1992 |
| **INDONESIA** | | |
| Olefin Center Shell Group | 50.0 | 1993 |
| Pertamina | 375.0 | 1993 |
| **JAPAN** | | |
| Mitsubishi Petrochemical Co. | 450.0 | 1993 |
| Osaka Petrochemical | 60.0 | ? |
| Showa Denko | 120.0 | 1990 |
| Sumitomo | 45.0 | 1990 |
| **KOREA** | | |
| Han Yang Chemical Corp. | 350.0 | 1991 |
| Honam Petrochemical | 350.0 | 1991 |
| Hyundai Petrochemical | 350.0 | 1991 |
| **MALAYSIA** | | |
| Exxon Chemical Co. | 450.0 | 1994 |
| **PHILIPPINES** | | |
| Luzon Petrochemical Corp. | 230.0 | 1992 |
| **TAIWAN** | | |
| China Petroleum Corp. | 400.0 | 1992 |
| **THAILAND** | | |
| Thai Olefins Co. | 350.0 | 1993 |
| **INDIA** | | |
| National Petrochemical Corp. | 100.0 | ? |
| Indian Petrochemical Corp. | 300.0 | 1991 |
| **EGYPT** | | |
| Egyptian Petrochemical Co. | 200.0 | 1991 |
| **IRAN** | | |
| National Petrochemical Co. | 376.0 | 1993 |
| **IRAQ** | | |
| Iraq Oil | 450.0 | 1992 |
| National Petrochemical | 336.0 | 1992 |
| Techcorps | 450.0 | 1992 |
| **NIGERIA** | | |
| NNPC | 400.0 | 1992 |
| **SAUDI ARABIA** | | |
| Petrokemya | 500.0 | 1993 |
| Sabic/Mobil | 500.0 | 1993 |
| **Total estimated capacity additions** | **19,754.9** | |

* From OGJ construction surveys, 1989-90

about 3.5-4.0%/year throughout the decade, according to Ryan. Growth rates in the Asia/Pacific region could run at about 5%/year by the end of the decade, and the growth rate in Latin America could run at about 4.6%/year during the last half of the 1990s.

LDPE supply and demand should remain in good balance throughout the 1990s, according to Ryan, if an important assumption is made. That assumption is that if HDPE demand continues to grow at about 4%/year, the swing, low-pressure plants that can make either HDPE or LDPE will continue to make their share of HDPE.

That would keep LDPE operating rates close to 90% throughout the decade. Ryan says that, with that assumption, by 2000 LDPE supply could become tight.

However, if HDPE growth falls significantly below 4%/year, swing plants would switch to LDPE production, lowering LDPE operating rates to about 70%.

There is a short-term overcapacity situation currently in the U.S., according to Ryan, but this should correct itself in 2-3 years.

In Western Europe, capacity and demand are in balance, for the most part. Many of these plants are older, high-pressure plants, but rebuilding plans will probably be extended.

Another factor in LDPE demand is the share of the LDPE market occupied by linear low-density polyethylene (Lldpe). Lldpe accounts for about 28% of the LDPE market in the U.S., 32% in Canada, and about 18% in Western Europe, according to Ryan.

Worldwide, Lldpe holds about a 22% market share of the total low density market. That share is expected to grow to about 34% by 2000.

Much of the swing capacity currently being built will be devoted, to a large part, to LDPE production, says Ryan. Swing capacity was only 16.8% of the total LDPE capacity in 1983, but it could grow to more than half of LDPE capacity by 2000.

### High-density polyethylene

HDPE demand is expected to grow at about 4%/year until about 1993, according to Dennis L. Rohlfing of Phillips 66 Co., Pasadena, Tex.[2] HDPE capacity is tight currently as a result of the explosion at the Phillips Pasadena plant in the spring of 1990, and as a result of cold weather on the Gulf Coast, which limited ethylene production last winter.

But capacity additions will ease that as the decade progresses.

For instance, about 1.3 million metric tons/year of HDPE new or rebuilt capacity will come on stream in the U.S. by 1991, according to Rohlfing. HDPE could experience overcapacity in the period 1991-1993 (Fig. 2).

### Polystyrene

Polystyrene capacity and demand should remain in decent balance through the 1990s, keeping operating rates close to 90% worldwide, according to Mark A. Bruner of Huntsman Chemical Corp., Chesapeake, Va. (Fig. 3).[3] He expects global polystyrene demand to rise to about 11.8 million metric tons/year by 1998, with capacity at about 14.1 million metric tons/year by then.

Much of the growth in polystyrene demand will likely come from Eastern Europe and China as the economies of those regions accelerate during the decade. These regions consume polystyrene at per capita levels well below those of developed regions. For instance, Eastern Europe consumes 3.9 lb/capita, Asia and the Far East 2.7 lb/capita, Latin America 1.8 lb/capita, and China, only 0.4 lb/capita. Those consumptions are contrasted with the U.S. at 20.9 lb/capita and Western Europe at 14.1 lb/capita.

### Polyvinyl chloride

There will not be a repeat in the 1990s of the decline in PVC demand that was experienced during the early 1980s, according to Fred Sacks of Occidental Chemical Corp., Berwyn, Pa.[4] PVC markets are much stronger today, and they will likely remain steady through the 1990s.

Significant capacity increases in the U.S. will put pressure on operating rates and prices for the next 5 years, but worldwide operating rates should not go below 84% through the 1990s.

Demand is projected to rise to about 21 million metric tons/year in 1994 from about 16 million metric tons/year in 1987 (Fig. 4), according to Sacks.

Capacity will move up to about 24.2 million metric tons/year by 1994, from about 18 million metric tons/year in 1987.

Operating rates could drop to about 87% during the first 2 years of the 1990s, and dip further to about 84% by 1994. They are expected, however, to recover to the upper 80% region after 1994.

Sacks points to PVC's growing market share for large-diameter pipe applications and an increasing market for PVC siding and windows as important driving forces for steady demand for PVC.

For ethylene producers, the derivatives markets look reasonably steady throughout the 1990s. If global economics stay healthy, and if, as expected, some of the large planned ethylene capacity expansions are delayed or downsized, ethylene producers should be able to remain profitable, despite the current softness of the market.

**References**

1. Ryan, Donald, Union Carbide Corp., "World Low Density Polyethylene Markets," paper presented at the DeWitt 1990 Petrochemical Review, Houston, Mar. 27-29, 1990.
2. Rohlfing, Dennis L., Phillips 66 Co., "Today's High Density Polyethylene Markets and Future Opportunities," paper presented at the DeWitt 1990 Petrochemical Review, Houston, Mar. 27-29, 1990.
3. Bruner, Mark A., Huntsman Chemical Corp., "Trends in World Polystyrene Markets," paper presented at the DeWitt 1990 Petrochemical Review, Houston, Mar. 27-29, 1990.
4. Sacks, Fred, Occidental Chemical Corp., "The World of PVC in the 90s," paper presented at the DeWitt 1990 Petrochemical Review, Houston, Mar. 27-29, 1990.

# New catalysts meet fuels challenges of the 1990s*

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* †g/cc | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **Isomerization (xylenes) catalysts** | | | | | | | | |
| IS 652 | Xylenes isomerization | Mized xylenes, ethylbenzene | p,o xylene | Ext. | †0.6 | Special | Pt | x |
| **Fluid catalytic cracking catalysts** | | | | | | | | |
| ELZ-2050S | High bott. crack., high oct., low coke | Resid | Gaso. + LCO | MS | †0.7 | $SiO_2/Al_2O_3$ | Zeolite | x |
| ELZ-0260S | | " | " | " | " | " | " | x |
| ELZ-2070S | " | " | " | " | " | " | " | x |
| ELZ-2250S | High liq., high V tol., high oct., and low coke | Resid | Gaso. + LCO | MS | †0.7 | $SiO_2/Al_2O_3$ | Zeolite | x |
| ELZ-2260S | | " | " | " | " | " | " | x |
| ELZ-2270S | " | " | " | " | " | " | " | x |
| RCZ-570S | High oct., low coke, high metal tolerance | FCC feed | Gasoline | MS | †0.75 | $SiO_2/Al_2O_3$ | Zeolite | x |
| XP-8000GL | Novel active matrix for range selective bottoms cracking | All types, wide of octane bbl appl.'s | High oct. bbl, low bottoms yield | MS | †0.73 | $SiO_2/Al_2O_3$ | G zeolite | x |
| XP-750C | " | | " | " | " | " | Z-14C USY | x |
| XP-750L | " | " | " | " | " | " | Z-14L USY | x |
| XP-750G + | " | " | " | " | " | " | G zeolite | x |
| XP-750 + | " | " | " | " | " | " | Z-14 USY | x |
| XP-750G | " | " | " | " | " | " | G zeolite | x |
| XP-750 | " | " | " | " | " | " | Z-14 USY | x |
| ORION-842 | Optimum coke and gas select. for metals applications | All types | High oct. bbl with high metals toler. | MS | †0.75 | $SiO_2/Al_2O_3$ | Z-14 USY/MMP | x |
| ORION-432G | " | " | " | | " | " | G zeo./MMP | x |
| ORION-910G | " | " | " | | " | " | G zeo./MMP | x |
| ORION-910 | " | " | " | | " | " | Z-14 USY/MMP | x |
| ORION-900 | " | " | " | | " | " | " | x |
| ORION-710 | " | " | " | | " | " | " | x |
| Super Resoc | High oct. prod. with motor octane emphasis | All types | High MON bbl with imp. metals tol., bottoms upgrade | MS | †0.75 | $SiO_2/Al_2O_3$ | Z-14 USY | x |
| Resoc-G | " | " | " | " | " | " | G zeolite | x |
| Super Resoc† | " | " | " | " | " | " | Z-14 USY | x |
| Super Resoc M | " | " | " | " | " | " | " | x |
| Super Octacat-RN Ext | Max. (R + M)/2, coke select | All types | Highest oct., coke and gas selectivity | MS | †0.72 | $SiO_2/Al_2O_3$ | G zeolite | x |
| Octacat-DGL | " | " | " | " | " | " | " | x |
| Octacat-DG | " | " | " | " | " | " | " | x |
| Octacat-G | " | " | " | " | " | " | " | x |
| GO-35G | High act. oct. bbl for best coke & dry gas selectivity | CGO, and high N feeds | High oct. bbl, N tolerance, cont'ld bromine No. | MS | †0.72 | $SiO_2/Al_2O_3$ | G zeolite | x |
| GO-30 | " | " | " | " | " | " | Z-14 USY | x |
| ASTRA-180 | High act. dual zeo. system | All types | High gaso. yield, high iso-$C_4$ yield | MS | †0.75 | $SiO_2/Al_2O_3$ | Z-14 USY/REY | x |
| Additive O-HS | | | RON, MON improve. | MS | †0.75 | $SiO_2/Al_2O_3$ | ZSM-5 | x |
| OMEGA-154 | Oct. bbi, enhanced bott. crkg. | GO, resid, red. crude | High Stab. met. tol., oct. bbl | MS | †0.76 | $SiO_2/Al_2O_3$ | LZ-210K, hi act. matrix | x |
| OMEGA-154BII | Max. bottoms cracking | " | Min. bottoms | " | " | " | " | x |
| OMEGA-162 | Max. (R + M)/2, enh. bott. crkg. | " | High olefinicities max. (R + M)/2 gaso. | " | †0.75 | " | " | x |
| OMEGA-1[illegible] | High oct., max. oct. bbl | " | High stab., metals tol., oct. bbl | " | " | " | " | x |
| **Mild hydrocracking catalysts** | | | | | | | | |
| HOP-501 | Conversion & HDS | VGO | Mid. dist. | Sh. Ext. | P | $Al_2O_3$ | P | x |
| HOP-551 | " | " | " | " | P | " | P | x |
| **Hydrotreating/hydrogenation, saturation catalysts** | | | | | | | | |
| TK-525 | Extra high HDS, HDN | Diesel to HVGO | FCC feed | Cyl. | 41 | $Al_2O_3$ | NiMo | x |
| LD402 | Total aro. hydrog., S present | | Solv., jet white oil | Ext. | †0.6 | $Al_2O_3$ | Pt | x |
| LD746 | Total hydrog. | Solv., aldehydes, ketones to alcohols | Cyl. | | †0.6 | Special | Pt | x |
| LT261 | Select. hydrog. of acetylene in ethylene | | | | | | | |
| LT279 | Select. hydrog. of acetylene in ethylene | Ethylene cut (vapor) | Ethylene | Sph. | | $H_2O_3$ | Pd | x |
| **Hydrorefining catalysts** | | | | | | | | |
| ACTMAX | Superior high HDS, long life | Amt. vac. resid | Desulfurized oil | Cyl. | †0.7 | $Al_2O_3$ | | x |
| CDS-D21 | Superior high HDS activity | Kero., diesel, VGO | Kero., diesel VGO | Cyl. | †0.73 | $H_2O_3$ | | x |

## New catalysts meet fuels challenges of the 1990s*—(continued)

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* †g/cc | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| TK-709 | Low HDS, high HDM, high metals | Atm., vac. resid | | Ring | 25 | $Al_2O_3$ | Mo | x |
| TK-710 | Med. HDS, high HDM, high metals | " | | Ring/cyl. | 31/38 | " | CoMo | x |
| TK-711 | " | " | | | " | " | CoMo | x |
| TK-750 | Good HDS, mod. HDM, metals tol. | " | | " | " | " | NiMo | x |
| TK-751 | " | " | | " | " | " | NiMo | x |
| TK-770 | High HDS, Low HDM, metals tol. | " | | Cyl. | 40 | " | CoMo | x |
| TK-771 | " | " | | " | 42 | " | NiMo | x |
| TK-753 | Reduced sludge formation | Resid | Hydrocracking | " | 36 | " | NiMo | x |

§These catalysts are not new but omitted from the 1989 compilation.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HOP-601 | HDM with high metal tolerance | Atm., vac. resid | Demetallized oil | Sh. ext. | P | $Al_2O_3$ | P | x |
| HOP-611 | High HDM with HDS | " | " and desulf. oil | Sh. & Cyl. | P | " | P | x |
| HOP-802 | High HDS | " | Desulf. oil | " | P | " | P | x |
| HOP-811 | High HDN with HDS | " | Denit. & desulf. oil | " | P | " | P | x |
| HOP-412 | Sup. high HDN/HDS | Nap., VGO, Lube oil | Desulf. nap., VGO lube base oil, FCC | Sh. Ext. | P | " | P | x |
| HOP-461 | " | Nap., kero., GO, VGO | Desulf. nap., kero. GO, VGO | " | P | " | P | x |
| HOP-491 | High HDS/HDN | Nap., kero., GO, VGO | Desulf. nap., kero. GO, VGO | " | P | " | P | x |

## Steam hydrocarbon reforming catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 121 | S Removal | Tail gas | S free gas | Ext. | P | P | Ni | x |
| 122 | " | Ref. gas, nat. gas | " | " | P | P | Cu | x |
| 150 | " | Nat. gas, naphtha | " | " | 1.15 | None | ZnO | x |
| 500 | Shift conv., S tolerant | Proc. gas | " | " | P | P | CoMo | x |
| C18-4-01 | Low temp. shift conv. | High act., long life | Hydrogen | Tab. | 80 | – | Copper | x |

## Sulfur (elemental) recovery catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S-400 3/16 | Optimized pore structure, low pressure drop and attrition | Claus feed | All converters and subdewpt tail gas | Sph. | 43 | Act. $Al_2O_3$ | Act. $Al_2O_3$ | x |
| SP-400 3/16 | Promoted. Optimized pore struct. | COS & $CS_2$ Conversion | First cat. conv. for OS & $CS_2$ conversion | Sph. | 45 | " | " | x |

## Sweetening catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LCPS 30 | Active agent dissolved in water | LPG, gaso., jet | | Liquid | | | P | x |
| CPS 59 | | Gaso., jet | | Solid | 1 | Special | P | x |
| CMG 273 | Hg removal in nat. gas | | | Sph. | | $Al_2O_3$ | P | x |

## Other refining catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| R 3-11 | CO, $O_2$, and S removal | Ethylene | Polymer grade | Tab. | †0.9 | P | CuO | x |
| R 3-12 | COS, arsine removal | Propylene | | " | †1.15 | P | CuO, ZnO | x |
| O 3-14 | Oxychlorination | Ethylene | Ethylene chloride | Ring | †0.9 | P | $CuCl_2$ | x |
| O 4-80 | NOx removal | Nitric acid offgas | $N_2$ | Cyl. ext. | †1.1 | $Al_2O_3$ | $V_2O_5$ | x |
| O 4-81 | " | Indust. offgas | " | Ring. | †0.8 | $TiO_2$ | " | New |
| O 4-85 | " | Offgases | " | Honeycomb | †0.6 | " | " | x |
| S 6-25 | Styrene | Ethylbenzene | Styrene | Cyl. ext. | †1.1 | | Fe, K oxides | New |
| LK-321 | Low temp CO conv., S resist. high act., long life | HT shift effluent | Gas, 0.1-0.3% CO | Cyl. | 62 | | Cu, Zn oxides | x |
| SK-201 | High temp. CO conv., high act. no byproducts at low S/C ratio | Steam ref. effluent | Gas, 2-3% CO | " | 75 | | Fe, Cr oxides | x |
| KK-142 | High temp. CO conv., high act. at low S/C ratio, no byproducts | " | " | " | | | Cu oxides | x |
| Catofin | Light paraffin dehydrog. | | | P | P | $Al_2O_3$ | Cr | L |
| Catadiene | Butene olefin dehydrog. | | | P | P | " | " | L |

## Sulfur oxides reduction catalysts (FCC)

| Catalysts designation | Characteristics | Form | How introduced to FCC System |
|---|---|---|---|
| Additive R | Reduces regen flue gas SOx emissions | MS | Added with FCC catalyst |

*New additions to Oct. 2, 1989, compilation, OGJ, Oct. 2, 1989, p. 49.

**Abbreviations for catalyst compilation**

**ABD**—Apparent bulk density; **AGO**—Atmospheric gas oil; **ARO.**—Aromatic or aromatics; **BTX**—Benzene, toluene, xylenes (aromatics); **Cet.**—Cetane; **CGO**—Coker gas oil; **Cyl.**—Cylinder; **DAO**—Deasphalted oil; **Dist.**—Distillate or distillates; **DMO**—Demetallized oil; **DO**—Diesel oil; **Ext.**—Extrudate; **FCC**—Fluid catalytic cracking or FCC unit; **GO**—Gas oil; **Gaso.**—Gasoline; **HAGO**—Heavy atmospheric gas oil; **HC**—Hydrocracking or hydrocracked; **HDM**—Hydrodemetallization; **HDN**—Hydrodenitrogenation; **HDS**—Hydrodesulfurization; **HDT**—Hydrotreating or hydrotreated; **HFO**—Heavy fuel oil; **HGO**—Heavy gas oil; **HSFO**—High sulfur fuel oil; **HVGO**—Heavy vacuum gas oil; **Jet.**—Jet fuel; **Kero.**—Kerosine; **LCO**—Light cycle oil; **LGO**—Light gas oil; **LSFO**—Low sulfur fuel oil; **LSR**—Light straight run; **MHC**—Mild hydrocracking; **MS**—Microsphere; **Oct.**—Octane; **'P'**—Proprietary; **Prom.**—Promoted or promoter; **RE**—Rare earth; **RDS**—Residual desulfurization; **SA**—surface area; **SR**—straight run; **Stab.**—stable or stability; **Sph.**—Sphere; **Sh. ext.**—Shaped extrudate; **VGO**—Vacuum gas oil; **Zeo.**—Zeolite; **x**—Unrestricted availability; **L**—Available under license only

# OGJ international refining-catalyst compilation—1989

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **Catalytic naphtha reforming catalysts** | | | | | | | | |
| **CHEVRON RESEARCH CO.** | | | | | | | | |
| Rheniforming | Latest version, long cycle life | Napthas, SR & cracked coal naphthas | Gas & BTX | Cyl. | 40 | "P" | Pt/Re | Contact Chevron |
| Type F | stable product yields | | " | " | " | " | " | |
| Type F | More stab. than F, higher sever. operations | | | | | | | |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| AEROFORM PHF-5 & 5A | Monometallic, differing particle size | Naphtha | Gaso. or BTX | Cyl. | 42 | $Al_2O_3$ | "P" | x |
| PRHF–30<br>PRHF–37<br>PRHF–50<br>PRHF–58 | Bimetallic, different amounts of active metals | Naphtha | Gaso. or BTX | Cyl. | "P" | " | "P" | L |
| KX-120, KX-130, KX-160 | (See Exxon Research & Engineering listings) | | | | | | | |
| TRILOBE KX-130 | (See Exxon Research & Engineering listing) | | | | | | | |
| AEROFORM PHF-4 & 4A | Monometallic, Diff. particle sizes | Naphtha | Gaso. or BTX | Cyl. | 42 | $Al_2O_3$ | PtCl | x |
| TRILOBE P-8 & P-8A | Monometallic, high particle Density, diff. sizes | Naphtha | " | Sh. xt. | 44 | " | " | x |
| AEROFORM PR-6 & 6A | Bimetallic, diff. part. sizes | Naphtha | " | Cyl. | 42 | " | Pt/ReCl | x |
| TRILOVE PR-8, 8A & 8E | Bimetallic, high part. dens., diff. part. sizes | Naphtha | " | Sh. ext. | 44 | " | " | x |
| TRILOBE PR-18 & 18A | Bimetallic, high part. dens., shaped skewed metals levels, diff. part. sizes | Low sulfur naphtha | " | " | 44 | " | " | x |
| IMP RNA-2 | (See Instituto Mexicano del Petroleo listing) | | | | | | | |
| **CYANAMID KETJEN** | | | | | | | | |
| CK-303 | All monometallics, diff. active metal contents | Naphtha | Gaso. or BTX | Cyl. | 40 | $Al_2O_3$ | PtCl | x |
| CK-304 | | " | " | | " | " | " | x |
| CK-305 | " | " | " | | " | " | " | x |
| CK-306 | " | " | " | | " | " | " | x |
| CK-433 | Bimetallic | Naphtha | " | " | 44 | " | Pt/ReCl | x |
| CK-522 TRILOBE | Bimetallic, high part. dens. | Naphtha | " | Sh. ext. | 44 | " | " | x |
| CK-542 TRILOBE | High Re, high part. dens. shaped catalyst | Low sulfur naphtha | " | " | 45 | " | " | x |
| PHRF-30 | Multimetallic | Naphtha | " | Cyl. | "P" | " | "P" | L |
| CK-473 | High-Re catalyst | Naphtha | " | " | 44 | " | Pt/ReCl | x |
| KX-120, 120T, 130, 130T, 160, 160T | (See Exxon Research & Engineering catalystic reforming listing) | | | | | | | L |
| **ENGELHARD CORP.** | | | | | | | | |
| E-301 | Moderate stability | Naphthas, S < 5 ppmw | Gaso. or Aro. | Cyl. | 45 | Al203 | Pt | x |
| E-302 | More stable than E-301 | Naphthas, S < 10 ppmw | " | " | 45 | " | " | x |

(Continued)

## Abbreviations for catalyst compilation

**ABD**—Apparent bulk density
**AGO**—Atmospheric gas oil
**ARO.**—Aromatic or aromatics
**BTX**—Benzene, toluene, xylenes (aromatics)
**Cet.**—Cetane
**CGO**—Coker gas oil
**Cyl.**—Cylinder
**DAO**—Deasphalted oil
**Dist.**—Distillate or distillates
**DMO**—Demetallized oil
**DO**—Diesel oil
**Ext.**—Extrudate
**FCC**—Fluid catalytic cracking or FCC unit
**GO**—Gas oil
**Gaso.**—Gasoline
**HAGO**—Heavy atmospheric gas oil
**HC**—Hydrocracking or hydrocracked
**HDM**—Hydrodemetallization
**HDN**—Hydrodenitrogenation
**HDS**—Hydrodesulfurization
**HDT**—Hydrotreating or hydrotreated
**HFO**—Heavy fuel oil
**HGO**—Heavy gas oil
**HSFO**—High sulfur fuel oil
**HVGO**—Heavy vacuum gas oil
**Jet.**—Jet fuel
**Kero.**—Kerosine
**LCO**—Light cycle oil
**LGO**—Light gas oil
**LSFO**—Low sulfur fuel oil
**LSR**—Light straight run
**MHC**—Mild hydrocracking
**MS**—Microsphere
**Oct.**—Octane
**'P'**—Proprietary
**Prom.**—Promoted or promoter
**RE**—Rare earth
**RDS**—Residual desulfurization
**SA**—surface area
**SR**—straight run
**Stab.**—stable or stability
**Sph.**—Sphere
**Sh. ext.**—Shaped extrudate
**VGO**—Vacuum gas oil
**Zeo.**—Zeolite
**x**—Unrestricted availability
**L**—Available under license only

## Catalytic naphtha reforming—continued

| Catalyst designation | Primary differentiation characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| E-311 | Maximize LPG production | Naphthas, S < 5 ppmw | LPG gaso. | Cyl. | 45 | " | " | x |
| E-601 | High stability | Naphthas, S < 1 ppmw | Gaso. or Aro. | " | 45 | " | Pt, Re | x |
| E-603 | High stab.,lower metal load | Naphtha, S < 1 ppmw | " | " | 45 | " | " | x |
| E-611 | Very high stability | Naphtha, S = 0.1 ppmw | " | " | 45 | " | " | x |
| (Note: Preceding catalysts available in higher density at 49.5 lb/cu ft. They are designated HD, i.e. E-301HD) | | | | | | | | |
| E-801 | Stab. of E-603 at higher act. | Napatha S <1 ppmw | Gaso. or Aro. | Cyl. | 51 | Al203 | Pt/Re | x |
| E-802 | Stab. of E-611 at higher act. | Naphtha. S < 0.5 ppmw | " | " | 51 | " | " | x |
| E-803 | Stab. of E-611 at higher act. opt. metals loading | | " | " | 51 | " | | x |
| E-804 | Stab. & Act. of E-801, opt. metals loading | " | " | " | 51 | " | " | x |
| **EXXON RESEARCH & ENGINEERING CO.** | | | | | | | | |
| KX-120 | Multimetallic semiregen. or cyclic units; diff. promotor | Virgin/cracked naphthas | High oct. gaso & Aro. | | | | Pt, etc. | L |
| KX-130 | " | | | | | | | |
| KX-160 | " | " | " | | | | | |
| **INSTITUTO MEXICANO DEL PETROLEO** | | | | | | | | |
| IMP-RNA-1 | High activity bimetallic | Desulfurized naphtha, aro. production | BTX high oct. gaso. | Cyl. | 0.70* | $Al_2O_3$ | Pt/Re | L |
| IMP-RNA-2 TRILOBE | " | " | " | Ext. | 0.70* | " | " | L |
| **KATALYSATORENWERKE HÜLS GmbH** | | | | | | | | |
| H-2440 | | Fraction 35-195 °C. | Gaso. or BTX | Cyl. exts. | 0.8* | $Al_2O_3$ | Pt, 0.3-0.8% monometallic | x |
| H-6413 | | " | " | " | 0.6* | " | " | x |
| H-2462 | | " | " | " | 0.6* | " | Pt, 0.3-0.8% + "P" | x |
| **PROCATALYSE** | | | | | | | | |
| RG-412 | H.P. reformer | Naphtha | Gaso. | Cyl. | | $Al_2O_3$ | Pt 0.35% | x |
| RG-482 | M.P. & L.P. reformer | " | Gaso. | " | " | " | Pt 0.3% + Re | x |
| RG-492 | " | " | Gaso. | " | " | " | Pt/Re | x |
| RG-442 | Reformer | " | Gaso. & LPG | " | " | " | PT + IR + promoter | |
| CR-201 | Cont. regen. reformer | " | Gaso. | Sph. | " | " | PtSN | x |
| AR-401 | Cont. regen. reformer (Aromizing-IFP) | " | Aro. | " | " | " | Pt/promotor | L |
| AR-403 | " | " | Aro. | " | " | " | " | L |
| AR-405 | CCR (IFP aromizing) | " | " | " | " | " | " | x |
| MD-101 | Sulfur removal | " | Naphtha | " | " | " | | x |
| **UOP** | | | | | | | | |
| R-11# | Higher act. monometallic | Semi-regen. or swing | Gaso. aro. | Sph. | 32 | $Al_2O_3$ | Pt | Contact UOP |
| R-12# | Monometallic, higher stab. than R-11 | Semi-regen. | " | " | 32 | " | Pt | " |
| R-55# | Monometallic, higher stab. than R-12, | Semi-regen. or swing | " | Ext. | Dense loaded 52 | " | " | " |
| R-15# | Monometallic | Semi-regen. | LPG, Gaso. | Sph. | 32 | $SiO_2/Al_2O_3$ | " | " |
| R-16H# | Bimetallic, higher stab. than monometallics | High severity, semi-regen. | Gaso. Aro. | " | 32 | $Al_2O_3$ | Pt/Re | " |
| R-16F# | Bimetallic, low Pt, higher stab. than monometallics, | High severity, semi-regen. | " | " | 32 | " | " | " |
| R16G# | Bimetallic, higher act. & stab. than -16F & H, | " semi-regen. | " | " | 32 | " | " | " |
| R-18# | Bimetallic, higher act. & stab. than R-16 series, | " semi-regen. | " | " | 37 | " | " | " |
| R-22# | Bimetallic, higher yields, reduced state | CCR or semi, regen. | Higher pro. of oct. bbl & aero. | " | 32 | " | "P" | " |
| R-30 | " | CCR or swing | " | " | 35 | " | "P" | " |
| R-32 | " | CCR | " | " | 35 | " | "P" | " |
| R-50# | Bimetallic, higher act. & stab. than R-16 series, | High severity, semi-regen. | Gaso. or Aro. | Ext. | Dense loaded 52 | " | Pt/Re | " |
| R-51 | " | " | " | " | 43 | " | " | " |
| R-60# | Bimetallic, higher stab. than R-50, high act. | " | " | Sph. | 45 | " | " | " |
| R-62 | Bimetallic, Lower Pt than R-60, higher stab. than R-50 high act. | " | " | " | 44 | " | " | " |

†Reduced and sulfided.

## Dimerization catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **KALI-CHEMIE AG** | | | | | | | | |
| Beadcat PK Series | Mechanical and thermal stab. | $C_3/C_4$ olefins | Gaso. | Bead | 0.80* | $SiO_2/Al_2O_3$ | Acid sites $Al_2O_3$ | x |
| **PROCATALYSE** | | | | | | | | |
| LC 1252 | | Propylene/ butylene | Gaso., hexenes, octenes | Liquid | | | Ni | L |

(Continued)

# Dimerization catalysts—continued

## Isomerization $C_4$ catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **BP** | | | | | | | | |
| BP Isom | High activity, regenerable | | | Cyl. | | $Al_2O_3$ | PtCl | L |
| **UOP INC.** | | | | | | | | |
| I-8 | Higher activity for n-butane isom to iso-butane | | | Ext. | 48 | $Al_2O_3$ | Pt | Contact UOP |
| **ENGELHARD CORP.** | | | | | | | | |
| RD-290C | Regenerable, high act. | | | Cyl. | 48 | " | PtCl | L |
| HPN-IVB | Select. hydrog. trace butadiene, isom butene to butene 2 | $C_3$, $C_4$ | Dimersol, alky feed | Sph. | 47 | "P" | "P" | L |

## Isomerization ($C_5$ & $C_6$) catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **BP** | | | | | | | | |
| BP Isom | High act., L.P. operation, regenerable | $C_5$, $C_6$ fractions | | Cyl. | | $Al_2O_3$ | PtCl | L |
| **ENGELHARD CORP.** | | | | | | | | |
| RD-290C | Regenerable, high activity | $C_5$, $C_6$ paraffins | | Cyl. | 48 | " | " | L |
| **PROCATALYSE** | | | | | | | | |
| IS-632 | Non-chlorinated, high act. | $C_5/C_6$ paraffins | High oct. gaso. or isomers | Ext. | 0.50* | Special | Pt | x |
| **UOP** | | | | | | | | |
| I-7 | High act., sulfur & water tolerant | SR or HDT $C_5/C_6$ streams | | Ext. | 36 | "P" | Pt | Contact UOP |
| I-8 | High act., L.P. application | " | | Cyl. | 48 | $Al_2O_3$ | " | " |
| HS-10 | Non-chloride activated, high tolerance for feed impurities | $C_5/C_6$ isom. | Octane upgrade | Cyl. | 46 | Mol sieve $Al_2O_3$ | Pt | L |

## Isomerization (xylenes) catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **ENGELHARD CORP.** | | | | | | | | |
| 0-750 | Xylene isom. | $C_8$ aromatics | p, o-xylene | Cyl. | "P" | "P" | Pt | L |
| **KALI-CHEMIE AG** | | | | | | | | |
| Beadcat PK series | Xylenes isom. | xylenes | p, o-xylene | Bead | 0.80* | $SiO_2/Al_2O_3$ | Acid sites | x |
| **UOP** | | | | | | | | |
| I-9 | High act. & high select. | Mixed xylenes, ethylbenzene | p, o-xylene | Sph. | 37 | "P" | "P" | Contact UOP |

## Fluid catalytic cracking catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMIE/AKZO CHEMIE AMERICA/KETJEN CATALYSTS** | | | | | | | | |
| Multicrack 20/200 | High liq. yields, good oct. | GOs, clean resids | Max. gaso., bott. upgrade | MS | 0.70-0.80* | Act. matrix | Zeo. | x |
| Multicrack 50/500 | " | " | Max. gao., | " | " | " | " | x |
| Multicrack + 20/200 | High oct., good liq. yields | " | Max. oct. bbl, bot. upgr. | " | " | " | " | x |
| Multicrack 50/500 | " | " | Max. oct. bbl, | " | " | " | " | x |
| Octaboost 600/610 | Max. RON, Bot. upgrading | GOs, resids | Max. oct., bottoms upgrading | MS | 0.70-0.80* | Adv. cat. system | USY zeo | x |
| Octaboost 600/160 G | Max. Ron/Ni resist/enhanced macroporosity | " + high metals feeds | Max. oct., low coke, gas, max. Ni resist. | " | " | " | " | x |
| Octaboost 620 | Max. MON | Gos, resids | Max. oct., max. branching, low coke gas | " | " | Act. matrix | ADZ 25 zeo. | x<br>x |
| Octaboost 620 G | Max. MON, low coke, gas | " + high metals feeds | " | " | " | Adv. cat. | " | x |
| Octaboost 620 S | Max. MON, Ni resist., enhanced macroporosity | " | Max. Ni resist., Max oct., max. branch. | " | " | " | " | x |
| Advance 400 | High liq. yield, red. coke gas. enhance macroporosity | GOs, resids, high metals feeds | Max. gaso., max. metals toler. | " | " | " | Zeo. | x |
| Advance 500 | Max. oct. bbl, red. coke, gas. enhanced macroporisty | " | MAS. oct. bbl, high MON, high met. toler. | " | " | " | " | x |
| Advance 700 | High liq. yields, high MON, red. coke, gas, enhanced macroporosity | " | Max. gaso., high MON Max. metals toler. | " | " | " | ADZ zeo. | x |
| Vision 40 | Max. oct. bbl, red. coke, gas, high RON, MON, enhanced macroporosity | GOs, resids | Max. oct. bbl., high MON | " | " | " | " | x |
| **CATALYSTS & CHEMICALS INDUSTRIES CO., LTD.** | | | | | | | | |
| MRZ-210 | Low act., high liq. yield | FCC feed | Gaso. & LCO | MS | 0.74* | $SiO_2/Al_2O_3$ | Zeo. | x |
| MRZ-220 | High liquid yield | " | " | " | " | " | " | x |
| MRZ-230 | " | " | " | " | " | " | " | x |
| MRZ-203 | High oct. metals tolerance | " | Gaso. | " | " | " | " | x |
| MRZ-204 | " | " | " | " | " | " | " | x |
| MRZ-206 | " | " | " | " | 0.72* | " | " | x |

(Continued)

# Fluid catalytic cracking catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft.* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| MRZ-203S | H[illegible] oct. metal tolerance, high hydrothermal stab. | FCC feed, high metals feed | " | " | 0.74* | " | " | x |
| MRZ-204S | " | " | " | " | " | " | " | x |
| MRZ-206S | " | " | " | " | 0.70* | " | " | x |
| MRZ-208 | High gaso. yield & oct. | FCC feed | " | " | 0.68* | " | " | x |
| MZR-208S | " | " | " | " | " | " | " | x |
| MRZ-230 | High gaso. yield, high metal feed tolerance | FCC feed, high metals feed | " | " | 0.74* | " | " | x |
| MRZ-240 | " | " | " | " | 0.74* | " | " | x |
| MRZ-250 | " | " | " | " | 0.70* | " | " | x |
| Hylic-30 | High liq. yield, high metals feed tolerance | FCC feed | " | " | 0.80* | " | " | x |
| -40 | | " | " | " | " | " | " | x |
| Hycon-20 | High oct., and metals tolerance, low coke | " | " | " | 0.78* | " | " | x |
| -30 | | " | " | " | " | " | " | x |
| -40 | " | " | " | " | " | " | " | x |
| Valec-50 | High oct., high V tolerance | " | " | " | 0.70* | " | " | X |
| Valec-60 | " | " | " | " | 0.68* | " | " | x |
| Valec-70 | " | " | " | " | 0.65* | " | " | x |
| BCZ-006S | High oct., low coke, high bot. cracking | FCC feed | " | " | | | | |
| BCZ-007S | " | Resid feed | " | " | | | | |
| BCZ-008S | " | " | " | " | | | | |
| RCZ-540 | High oct., low coke, high metal tolerarnce | FCC feed | " | " | 0.75* | " | " | x |
| RCZ-550 | " | " | " | " | " | " | " | x |
| RCZ-650 | " | " | " | " | " | " | " | x |
| Octup | Oct. additive | " | " | " | 0.70* | " | ZSM-5 | x |
| **CROSFIELD CATALYSTS** | | | | | | | | |
| XL Series | Bot. crack, & high gaso. and oct. selectivity | Gas oils | Bot. upgrade, high liq. product oct. and cet. | MS | | $SiO_2/Al_2O_3$ | Zeo. matrix | x |
| XL 60 | " | " | Low act. | " | 0.87* | " | " | x |
| XL 80 | " | " | Medium act. | " | 0.86* | " | " | x |
| XL 100 | " | " | High act. | " | 0.84* | " | " | x |
| SLS Extra series | High oct. gaso. liq. product | Gas oils, resids | Gaso., LCO, | " | | " | " | |
| SLS 60 Extra | | | Low act. | " | 0.75* | " | " | x |
| SLS 80 Extra | | | Med. act. | " | 0.74* | " | " | x |
| SLS 100 Extra | | | High act. | " | 0.72* | " | " | s |
| GLS Series | Coke select., gaso. mid. dist. oct., max. oct bbl | " | Max. gaso. oct. bbl, selective bot. crack. | | | | | |
| SLS-60 | " | " | " | " | 0.78* ABD | " | " | x |
| SLS-80 | " | " | " | " | 0.76* | " | " | x |
| SLS-100 | " | " | " | " | 0.76* | " | " | x |
| SLS extra series | High oct. gaso. liq. product | Gas oils, resids | Gaso., LCO | " | " | " | | |
| FLS 60 extra | Low act. | " | " | " | 0.75* | " | " | x |
| SLS 80 extra | Med. act. | " | " | " | 0.74* | " | " | x |
| SLS 100 extra | High act. | " | " | " | 0.72* | " | Zeo, CMT | x |
| QUANTUM Series | Max. octane low coke, gas select. | " | Oct., oct. bbls. | " | | " | Zeo. CMT | x |
| Quantum 80 | Oct. bbls., low coke/gas select. | " | Med. activity | " | 0.74* | " | " | x |
| 100 | " | " | Low act. | " | 0.72* | " | " | x |
| 2000 | Max. oct., oct. bbl, min. | " | Med. act. | " | 0.74* | " | " | x |
| Quantum M Series | Max. oct., coke, gas select. | " | Oct., oct. bbl | " | | " | " | x |
| Quantum 80 M | " | " | Med. act. | " | 0.72* | " | " | x |
| Quantum 100 M | " | " | Low act. | " | 0.70* | " | " | x |
| Vanadium trap (VT), FLuidization additive (CFA), and combustion promoter (CP) can be added to all catalysts | | | | | | | | |
| **DAVISON CHEMICAL DIVISION, W. R. GRACE & CO. (Each catalyst group arranged in decreasing order of activity)** | | | | | | | | |
| ASTRA-180 | High act. w/ oct. bbl yield optimized, dual zeo. system | GOs, resid, CGO high N feed | Max. oct. bbl | MS | 0.77* | $SiO_2/Al_2O_3$ | Z-14G-US/REHY | x |
| ASTRA-170 | | | " | " | " | " | " | x |
| ASTRA-180 | " | " | " | " | " | " | " | x |
| ASTRA-280 | " | " | " | " | " | " | " | x |
| ASTRA-278 | " | " | " | " | " | " | " | x |
| ASTRA-276 | " | " | " | " | " | " | " | x |
| ASTRA-378 | " | " | " | " | " | " | " | x |
| ASTRA-376 | " | " | " | " | " | " | " | x |
| ASTRA-374 | " | " | " | " | " | " | " | x |
| DA-440 | Max. unit ret. high act., bott. cracking | Gas oil, resid, high N feeds | Max. liq. yield | " | 0.82* | " | REY | x |
| DXB-150 | Bot. cracking w/ coke select. | " | Bot. upgrd. w/high oct. bbl yield | " | 0.77* | " | Z-14-US/REHY | x |
| DXB-410 | oct. bbl performance | " | | " | " | " | " | x |
| GENCAT-1 | High act. flushing, good coke and gas select. | GO, resid | Liq. yield, act. maint. in high metal | " | 0.78* | " | " | x |
| GENCAT-0 | | " | | " | " | " | " | x |
| GX-20 | High act., bot. cracking w/N and metals tolerance | GO resid, coker/high N feeds | Max. liq. yield | " | 0.74* | " | REY | x |
| GXO-29 | High act./stab. w/high oct. bbl yield, coke & dry gas select., hydrothermal stab. | GO, resid, coker, high N feeds | High oct. bbl | " | 0.77* | " | Z-14 US | x |
| GXO-28 | | | " | " | " | " | " | x |
| GXO-25+ | | " | " | " | " | " | " | x |
| GXO-25 | " | " | " | " | " | " | " | x |
| GXO-41 | High act. w/ low coke & gas, bott. upgrading | CO, resid, high N feeds | Max. liq. yields | " | 0.78* | " | REHY | x |
| GXO-40 | | | " | " | " | " | " | x |
| GXO-27 | " | " | " | " | " | " | " | x |

(Continued)

# Fluid catalytic cracking catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| Super Nova D | Max. oct. bbl min. coke, max. retent, bot. cracking | VGO/resids/CGOs high N feeds | Bot. retent, high oct. bbl | " | 0.80* | " | Z-14 US | x |
| Nova D | | | | " | " | " | " | x |
| Super Resoc | " | " | " | " | " | " | " | x |
| Resoc-1 | " | " | " | " | " | " | " | x |
| Resoc-2 | " | " | " | " | " | " | " | x |
| Resoc-1M | " | " | " | " | " | " | " | x |
| Resoc-G | " | " | " | " | " | " | " | x |
| Resoc-GM | " | " | " | " | " | " | " | x |
| Octacat + | Max. oct. w/ unsurpassed stab. & coke & dry gas select., metals tolerance | Go, resid, CGOs, high N feeds | Highest Gaso. octs. | " | 0.72* | " | Z-14 US | x |
| Octacat | | | " | " | " | " | " | x |
| Super Octacat-B + | | " | " | " | " | " | " | x |
| Super Octacat-B | " | " | " | " | " | " | " | x |
| Octacat RN + | " | " | " | " | " | " | " | x |
| Octacat RN | " | " | " | " | " | " | " | x |
| Octacat-D + | " | " | " | " | " | " | " | x |
| Octacat-D | " | " | " | " | " | " | " | x |
| Octacat-GD | " | " | " | " | " | " | " | x |
| Octacat-GDM | " | " | " | " | " | " | " | x |
| **ENGELHARD CORP.** | | | | | | | | |
| ULTRASIV-280 | US-280 highest act., van. toler. low gas, attrit. resist. | Gas oils, gas-oil resid mix resid | Incremental resid processing | MS | 1.1* | In situ $SiO_2$/$Al_2O_3$ | Zeo. mod. RE, Mod. SA | x |
| -260 | " | " | " | " | " | " | " | x |
| -250 | " | " | " | " | " | " | " | x |
| -240 | " | " | " | " | " | " | " | x |
| -230 | " | " | " | " | " | " | " | x |
| -220 | " | " | " | " | " | " | " | x |
| HEZ-55 | HEZ-55 highest act., EPZ designates CO promoted | Gas oils, high N-gas oils, Calif. gas oils | Bot. upgrade oct. bbl, cet. | MS | 1.0* | " | Zeo., moder., RE high SA | x |
| EPZ-55 | " | " | " | " | " | " | " | x |
| HEZ-54 | " | " | " | " | " | " | " | x |
| -53 | " | " | " | " | " | " | " | x |
| -52 | " | " | " | " | " | " | " | x |
| -50 | " | " | " | " | " | " | " | x |
| MAGNASIV-380 | MAG-380 highest, act., low coke, gas make, metal toler., upgrade | Gas oils, high N gas oils, Calif. gas oils | Max. liq. yield | " | 1.05* | " | Zeo., RE. | x |
| -370 | | | | | | | | x |
| -360 | | | | | | | | x |
| Octasiv Plus-680 | 680 highest act., stab. metals toler., hydrothermal stab., bot. upgrade | Gas oils, gas oil-resid, resid | Max. oct. bbl | MS | 1.0* | " | Ultrastable zeo., low RE, low matrix SA | x |
| -670 | | | | | | | | |
| -660 | | | | | | | | |
| -580 | 580 highest act., stab., metals toler., hydrothermal stab. | " | Max. olefin production | " | 1.0* | " | Ultrastable zeo. mod. matrix SA | x |
| -570 | | " | | " | " | " | | |
| -560 | " | " | " | " | " | " | | |
| -160 | 160 highest act., oct. adv. over REO | " | Bot. upgrade & metals toler. | " | 1.0* | " | Ultrastable zeo., low RE, mod. matrix SA | x |
| -150 | | " | | " | " | " | | x |
| -140 | " | " | " | " | " | " | | x |
| ULTRASOX | Available in a variety of cracking & S reduction acts. | High gas oils, gas oil resid mix | $SO_x$ reduction | " | 1.1* | " | Zeo., prop. $SO_x$ reduction | x |
| HFZ-33 | HFZ-33 highest act. | Gas oils | Olefins feed, high oct. cet. | " | 1.0* | " | Zeo., no RE, high SA | x |
| -20 | " | " | | " | " | " | | x |
| -23 | " | " | " | " | " | " | " | x |
| -25 | " | " | " | " | " | " | " | x |
| ULTRADYNE-980 | UD 980 highest act., low matrix SA | " | Low coke prod., low gaso., bromine No. high gaso. yield, low dry gas yield | " | 1.0* | " | Zeo. | x |
| -970 | | " | | " | " | " | " | x |
| -960 | " | " | | " | " | " | " | x |
| -950 | " | " | | " | " | " | " | x |
| -940 | " | " | " | " | " | " | " | x |
| -930 | " | " | " | " | " | " | " | x |
| ULTRADYNE PLUS- | UDP 1580 highest act., low matrix, oct. cat. | Gas oil, resid | Oct. bbl, low coke, dry gas | " | 1.0* | " | Ultrastable zeo., low RE, low matrix SA | x |
| 1580 | | | | | | | | x |
| 1560 | | " | | " | " | " | | x |
| 1550 | " | " | " | " | " | " | | x |
| 1540 | " | " | " | " | " | " | " | x |
| 1530 | " | " | " | " | " | " | " | x |
| Dynacat-1080, | DC 1080 highest act. V tolerant | Resid high metals gas oil | High act. maint. contaminated situations | MS | " | " | " | x |
| -1070 | | | | " | " | " | " | x |
| -1060 | | | | " | " | " | " | x |
| -1050 | " | " | " | " | " | " | " | x |
| -1040 | " | " | " | " | " | " | " | x |
| -1030 | " | " | " | " | " | " | " | x |
| Dynasiv-780 | DS 780 is highest act. | Gas oil, mild resid | Mod. oct. bot. upgrade, high gasc. select. | " | " | " | " | x |
| -770 | | | | " | " | " | " | x |
| -760 | | | | " | " | " | " | x |
| -750 | " | " | " | " | " | " | " | x |
| -740 | " | " | " | " | " | " | " | x |
| -730 | " | " | " | " | " | " | " | x |
| Dynasiv Plus-880 | DSP 880 is highest act. | Gas oil/ resid | Oct. gaso. select., bot. upgrade | " | " | " | Ultrastable zeo. | x |
| -870 | | | | | | | | |
| -860 | | | | " | " | " | " | x |
| -850 | " | " | " | " | " | " | " | x |
| -840 | " | " | " | " | " | " | " | x |
| -830 | " | " | " | " | " | " | " | x |

(Continued)

# Fluid catalytic cracking catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| OCTIDYNE-1170, | OD 1170 is highest act., RON, MON imp., low coke | Gas oil/ resid | Max. oct. max. gaso. select., reduced regen. temp | " | " | " | " | x |
| -1160 | | | | | | | | |
| -1150 | | | | " | " | " | " | x |
| -1140 | " | " | | " | " | " | " | x |
| -1130 | " | " | " | " | " | " | " | x |
| DYNASOX-1380, | DSX 1380 is highest act. | " | Mod. SOx red. gaso. select., bot. upgrade | " | " | " | Zeo. | x |
| -1370 | | " | | " | " | " | " | x |
| -1360 | | | | " | " | " | " | x |
| -1350 | " | " | " | " | " | " | " | x |
| -1340 | " | " | " | " | " | " | " | x |
| -1330 | " | " | " | " | " | " | " | x |
| Nitrodyne 1490 | ND 1490 is highest act. oct. cat. | High N feed, coker gas oils | High in-unit act., conver., bot. upgrade | " | 1.0* | $SiO_2/Al_2O_3$ | Zeo. | x |
| 1480 | | | | " | " | " | " | x |
| 1470 | | | | " | " | " | " | x |
| Z-100 | | Gas oil feed | RON, MON, imp., | " | " | " | ZSM-5 | x |
| VHS series | " | " | Max. oct., coke Select., bott. upg., low gas | " | " | " | No. RE, DY zeo. act. stab. crystalline alum. matrix | x |
| F/X series | Opt. oct, opt. gaso. yields | " | High oct., high gaso coke sel., bot. upg., low gas | " | " | " | " except low RE | x |
| FORCE series | High oct. from high met. ops. | Hvy. GOs, high met. resids | High oct, high gaso, coke sel., bot. upg., met. toler., low gas | " | " | " | " | x |
| FOCUS series | High oct. gaso., low gas, coke | GOs, resids | High oct., high gaso., coke sel., bott. upg., low gas | " | " | " | " | x |
| FSS series | Max. gaso., very stable | GOs, hvy. GOs, resids high N feeds, severe ops. | Max. gaso., coke sel., bot. upg. low gas | " | " | " | " except high RE & low soda | x |
| HRO series | Max. oct. bbl | GOs, hvy GOs, resids | Good oct., high gaso., coke sel., bot. upg, low gas | " | " | " | " except mod. RE | x |
| SOC series | Very stab., high act., low coke | Hvy. GOs, high metals resids | Good oct., high gaso., coke sel. bot. upg, met. tol. low gas | " | " | " | " | x |
| ROC series | Resists metals, low coke | " | " | " | " | " | " except high RE, & not low soda | x |
| OCTEX series | High yields, high oct. | " | " except high oct. | " | " | " | "except mod. RE | x |
| FOC series | " | " | " | " | " | " | " | x |
| FLEX series | General purp. | GOs, resids | Max. gaso. sel., min. gas make, for units not req. max. stab. bot upg., low gas | " | " | " | High RE DY zeo active stab. crystalline alum. matrix | x |
| EXSEL | General Purp. | " | high gaso. sel., bot. upg., metals toler., low gas | " | " | " | " except mod. RE | x |
| DOC series | Diesel oil production | " | Max. LCO yield, high cet., bot. upg., low gas | " | " | " | " except low RE | x |
| CAMPRO | Applied to all product lines, opt. matrix act. | GOs, hvy. GOs, resids | Opt. matrix act. of any Filtro FCC cat. | " | " | " | Active stab. crystalline alum. matrix | x |
| BCA | Bottoms cracking additive | High met. resids | Bot. upg., metals flush | " | " | " | "P" | x |
| ZSM-5 | Oct. additive | Paraffinic feeds | High oct. gaso. | " | " | " | Sh. sel. zeo. | x |
| **INTERCAT CORP.** | | | | | | | | |
| Z-CAT PLUS | Octane additive | FCC feeds | High oct. gaso. | " | 50 | "P" | ZSM-5 | x |
| **KATALISTIKS INTERNATIONAL** | | | | | | | | |
| Alpha 540 | High activity oct. | Gas oils, resids, red. crudes | Max. oct. bbl, high select. | MS | 0.74* | $SiO_2/Al_2O_3$ | LZ-210 act. matrix | x |
| -640 | " | | | " | 0.73* | " | | x |
| -545 | " | " | " | " | 0.74* | " | " | x |
| Beta-540 | Max octane | " | Max. octane, coke select. | " | 0.73* | " | " | x |
| -545 | Enhanced bot. crack, metal resis | " | | " | 0.73* | " | " | x |
| -640 | Max octane | " | " | " | 0.72* | " | " | x |
| -600 | Highest poss. octane | " | " | " | 0.72* | " | " | x |

(Continued)

# Fluid catalytic cracking catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| EPSILON-540 | High oct. with high act. | GO, resid, red. crude | High oct. w/high gaso. select. | " | 0.74* | " | " | x |
| -640 | " | " |  | " | 0.73* | " | " | x |
| -545 | Enhanced bot. crack., met. resis | " | " | " | 0.74* | " | " | x |
| Gamma-419 | High RON, MON, oct. bbl, high stab., excel. select. | " | High liq. mid-bbl yields, low gas, coke, 650+yields | " | 0.74* | " | High $SiO_2$ zeo. matrix | x |
| -419 Plus | " | " |  | " | " | " | " | x |
| -645 | Enhanced bot. crack., high RON/MON, metal. resist., good coke select. | " | " | " | " | " | " | x |
| Sigma-200 Plus | High oct. bbl, good coke, gas select., 5 act. levels for dist. gas operations | " | High liq., max mid-bbl yield, low coke, gas make | " | 0.76*ABD | " | LZ-210 in act. matrix | x |
| -300 Plus |  | " |  | " | 0.75* | " |  | x |
| -400 Plus |  | " |  | " | 0.74* | " | " | x |
| -500 Plus | Hi oct. bbl, w/good coke/gas sel | " | " | " | " | " | " | x |
| -600 Plus | " | " | " | " | 0.73* | " | " | x |
| -605 Plus | Enhanced bot. cracking | " | " | " | 0.73* | " | " | x |
| Sigma-200 | Gen. purp., high stab., 4 activity levels | Gas oil, resid, reduced crude, high N, coker gas oil | High liq., max. mid bbl yield, low 650+ yield, low gas, attr. res., low bromine No., balanced butane yields, high isobutane ylds. | " | 0.75* | " | Mixed prem. zeo. matrix | x |
| -300 |  |  |  | " | 0.74* | " |  | x |
| -400 | " |  |  | " | 0.74* | " | " | x |
| -600 | " |  |  | " | 0.73* | " | " | x |
| -605 | Enhanced bot. cracking | " |  | " | 0.74* | " | " | x |
| EKZ-2 | Gen. purp., 3 act. levels | Gas, dirty feeds, coker gas oils | High liq. yields low coke, gas | " | 0.79* | " | Fully ReO exch. zeo. | x |
| -3 | " |  |  | " | 0.78* | " |  | x |
| -4 | " | " | " | " | 0.76* | " | " | x |
| BMZ-200 | Flex. for max. dist. or gaso. | Gas oil, resid, red. crude, high N coker gas oil | High liq., max. mid bbl, low 650+ yields, low gas, attr. res., low bromine No., high isobutane yield | " | 0.76* | " | High $SiO_2$ fully RE zeo. matrix | x |
| -300 | " |  |  | " | 0.75* | " |  | x |
| -400 | " |  |  | " | 0.74* | " |  | x |
| -600 | " | " |  | " | 0.73* | " | " | x |
| -695 | Enhanced bot. cracking | " |  | " | 0.72* | " | " | x |
| Ekonocat-1 | Gen. purp., 2 act. levels | GO, dirty feeds, coker gas oils | High liq. yield, 1low gas, coke, low | " | 0.76* | " | Mixed zeo. low SA matrix | x |
| -2 | " |  |  | " | 0.72* | " |  | x |

**W.R. GRACE CATALYSTS PTY. LTD. (see complete listing of Davison Chemical Division, W.R. Grace & Co.)**

# Hydrocracking catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC./NIPPON KETJEN (All catalysts available as off-site presulfided)** | | | | | | | | |
| Ketjenfine, LC-Fining | (See Lummus Crest HC listing) | Resid HC |  | Cyl. |  | "P" | Co Mo | L |
| Ketjenfine H-oil (HRI Texaco) |  | Atm.vac. btms., hvy. crudes, bitumen, etc. | Dist., LSFO | " | " | "P" | CoMo & NiMo | L |
| Ketjenfine HC-143 | (See BP HC listing) | VGO HC |  | " | " | "P" | "P" | L |
| KC-2000 |  | VGO | Gaso./jet. | " | 48 | "P" |  | x |
| KC-2100 |  | " | Gasoline | " | 41 | "P" |  | x |
| KC-2200 |  | " | Mid. dist. | " | 54 | "P" |  | x |
| KC-2600 |  | " | " | " | 45 | "P" |  | x |
| **ARCO LYONDELL LICENSING INC.** | | | | | | | | |
| ARCO H-H Cat |  | Raw lube stock | High quality lube | " | 48 |  |  | L |
| **BP** | | | | | | | | |
| MD-2 |  | VGO | Mid. Dist. | " |  | "P" | "P" | L |
| **BASF AG** | | | | | | | | |
| M 8-81 | Hydrocracking | HGO, VGO | steam crckr. feed | Cyl. ext. | 0.70* | $SiO_2$ | Nio/$MoO_3$ | L |
| M 8-86 | " | " | Mid. dist. | " | 0.80* | "P" | " | L |
| **CHEVRON RESEARCH CO.** | | | | | | | | |
| ICR-106 | High HDN, high cracking act. 1st, 2nd stage, HC, stable | VGO, CGO, LCO, AGO 1st stg. HC prod | Diesel, jet, naphtha 2nd stage feed | " | 55-63 | "P" | "P" | L |
| ICR-120 | Max. diesel, 2nd stg. HC, Stable | " | Diesel, jet, naphtha | " | 50-58 | "P" | "P" | L |
| ICR-126 | High act., longer life than 106 | VGO/CGO/LCO/AGO | " + 2nd stg. feed | " | 55-63 | "P" | "P" | L |
| ICR-113 | Lower cost | " + DAO | " | " | 45-53 | "P" | "P" | L |
| ICR-117 | Naphtha yield | VGO, CGO, LCO, AGO | " | " | 50-58 | "P" | "P" | L |
| ICR-204 | High act., selec., long life | Hydrofined VGO, CGO, LCO | Reform. feed, lt. naphtha, jet | " | 53-61 | "P" | "P" | L |
| ICR-207 | Long cycle life |  |  | " | 32-40 | "P" | "P" | L |
| GC-36 | Max. gaso. HC | Dist. lt gas oils | Gaso., naphtha kero. jet | " | 50-60 | $SiO_2/Al_2O_3$ | "P" | x |
| GC-30 | Max. dist.HC | Dist., Hvy. VGO | Furnace oil, diesel, jet, kero. | " | 50-60 | " | "P" | L |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| IPB-2 |  | AGO, VGO | Gaso., dist. | Cyl. | Silicates | "P" | "P" | L |
| HC-102 | (See Unocal listing) |  |  |  |  |  |  |  |
| MD-2 | (See BP HC listing) |  |  |  |  |  |  |  |
| HDS-1442-B | Ebullating bed | Resid HDT |  | " | 34 | $Al_2O_3$, $MoO_3$ | CoO/Nio/$MoO_3$ | L |
| HDS-1443B | " | " |  | " | 36 | " | " | L |
| GC-30-36 | (See Chevron Research listing) |  |  |  |  |  |  |  |
| C 324 | HDN, 1st stage HC | Coal oil HC |  | " | 0.86* | $Al_2O_3$ | NiMO | x |
| 424 | " | 1st stage HC |  | " | 0.82* | " | " | x |
| 411 | " | " |  | " | 0.85* | " | " | x |
| Z 703 | (See Zeolist Enterprises HC listing) |  |  |  |  |  |  |  |
| 753 | " | " | " | " | 0.70* | Crystalline | " | x |

(Continued)

# Hydrocracking catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| C 354 | Hvy. dist. HC | " | | " | 1.02* | $Al_2O_3$ | " | x |
| 454 | " | | " | " | 1.05* | " | " | x |
| **ICI KALTALCO/ICI CATALYSTS** | | | | | | | | |
| 594 | HDN, 1st stage HC | AGO, VGO | 2nd stage feed | Katform | 51 | $Al_2O_3$ | Nio/$MoO_3$ | x |
| 599 | " | " | " | 1/16-1/8 | 57 | " | " | x |
| 545 | " | " | " | " | 50 | " | " | x |
| KAT 4000 | Ebullated bed HC | Resid (H-oil), (LC-Fining) | FCC feed | 1/32 cyl. | 34 | " | CoO/$MoO_3$ | x |
| 5000 | " | | " | " | " | " | " | x |
| **LUMMUS CREST INC.** | | | | | | | | |
| LC-Fining | Hvy. feed, metals tolerance | Atm. bott., vac. bot. hvy crudes, tars, etc. | Dist., low S fuel | Cyl. | Low | " | CoMo/NiMo | L |
| **PROCATALYSE** | | | | | | | | |
| HYC 642 | High cracking act. | Gas oil, VGO | Kero., GO | Ext. | | Special | NiMo | x |
| 632 | Cracking act. | " | GO | " | | " | " | x |
| 652 | High cracking act. | " | Naphtha, Kero. | " | | " | " | x |
| **UOP** | | | | | | | | |
| DHC-2 | Bifunctional, strong hydrogenation good crack. act. | VGO, DAO, CGO other non-SR gas oils | High select. to mid. dist. | Sph. | 41 | Amorphous | "P" | |
| -6 | Bifunctional, good hydrogeneration, very good crack. act. | " | " | " | 44 | " | "P" | |
| -8 | Bifunctional, excellent hydro. very good crack. act. imprv. temp. stability | " | " | " | 44 | " | "P" | |
| -100 | Bifunct. excell. hydro., imp., crack. act., greater temp. stab. | " | " | Ext. | "P" | "P" | "P" | |
| HC-8 | 2nd stage high act., very act., stable | " | High naphtha select. | Cyl. | 42 | Zeo. | "P" | |
| HC-100 | " + more act. than HC-8 | " | " | " | 48 | Zeo. | "P" | |
| HC-101 | High act., strong hydrog. | " | High LPG select. | " | 50 | Zeo. | "P" | |
| RCM-3 | High act., ebullating bed resid conver. units, high strength | Vac. resid | Naphtha, distillates, gas oils | Sph. | 41 | "P" | "P" | |
| RCM-4 | " | " | " | " | 39 | "P" | "P" | |
| HC-14, 16, 18, 22, 24, 28, 30, 80 | (See Unocal Corp. hydrocracking listing) | | | | | | | |
| **UNOCAL** | | | | | | | | |
| HC-14 | Flexibility for fuels | Virgin cracked dist., VGO | Gaso., kero., jet, dist. VGO | Cyl. | "P" | Mol sieve | Non-noble metals | L |
| HC-16 | " | | | " | "P" | " | | L |
| HC-18 | Max. gaso., LPG, naphtha | " | LPG, gaso., petchem. naphtha | " | "P" | " | Noble metals | L |
| HC-22 | Max. diesel, jet | " | Diesel, jet | " | "P" | " | Non-noble metals | L |
| HC-28 | Max. LPG, gaso., petchem. naphtha | " | LPG, gaso., petchem naphtha | " | "P" | " | Noble metal | L |
| HC-30 | Select. HC for pour pt. red. | Petroleum & shale oil | Low pour pt. dist. | " | "P" | " | Non-noble metals | L |
| HC-80 | " | fractions | lube stocks, syncrds | " | "P" | | | L |
| HC-102 | Max. diesel | Virgin & cracked | Diesel | Sh. Ext. | "P" | Amorphous | metals | L |
| **ZEOLIST ENTERPRISES** | | | | | | | | |
| Z-753 | Naphtha select., 2nd stg., imp. act., select., & stab. | SR and cracked GOs, VGO, recyc. or 1 pass | High naphtha select. | Ext. | 40 | Mole sieve | Non-noble metals | Contact Criterion |
| -703 | Dist. select., 2nd. stg., imp. act., select., & stab. | | High dist. select. | " | " | " | " | " |

# Mild hydrocracking catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC./NIPPON KETJEN (All catalysts available as off-site presulfided)** | | | | | | | | |
| KF-1011 | Conversion & HDS | VGO | Mid. dist. | Cyl. | 51 | $Al_2O_3$ | NiMo | x |
| KF-1012 | " | " | " | " | 42 | " | CoMo | x |
| KF-1014 | " | " | " | " | 42 | " | " | x |
| KF-1015 | " | " | " | " | 42 | " | NiMo | x |
| KC-2600 | " | " | " | " | 45 | " | "P" | x |
| TLF-141 (Elf) | "P" | Pour pt. protect. | | Cycl. | "P" | "P" | | L |
| **BASF AG** | | | | | | | | |
| M 8-82 | Mild HC | HGO, VGO | Mid. dist., FCC Feed | Cyl. ext. | 0.70* | $SiO_2$ | NiMo/$MoO_3$ | L |
| **BP** | | | | | | | | |
| MH-128 | Mid. dist. selectivity | VGO | " | Sh. ext. | 45 | "P" | "P" | x |
| **CATALYST & CHEMICALS INDUSTRIES CO. LTD.** | | | | | | | | |
| HT-D3 | High mid. dist. yield | VGO | Kero., diesel & desulf. | Cyl. | 0.76* | $Al_2O_3$ | | x |
| HT-D5 | " | " | | " | 0.78* | " | | x |
| HT-D7 | High HDS, mid. dist. yield | " | " | " | 0.78* | " | | x |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| HCM-40 | (See Unocal MHC listing) | | | | | | | |
| -110 | " | | | | | | | |
| MHC-1 | Combined conv. & HDS act. | VGO | Mid. dist. + treated | Cyl. | 0.86* | " | NiMo | x |
| MHC-200 | Low pressure MHC | " | " | " | 0.76* | " | CoMo | x |

(Continued)

# Mild hydrocracking catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **CHEVRON RESEARCH CO.** | | | | | | | | |
| ICR 106 | High cracking act., select for mid dist. | VGO, CGO, LCO, AGO | Diesel, FCC feed, LSFO | Cyl. | 55-63 | "P" | "P" | L |
| ICR-126 | Longer life, higher conv. | " | Diesel, naphtha, FCC feed, LSFO | " | 55-63 | "P" | "P" | L |
| ICR-114 | Lower cost | " | Diesel, FCC feed, LSFO | Cyl., sh. | 42-54 | "P" | "P" | L |
| **ENGELHARD CORP.** | | | | | | | | |
| HPC-50 | High act. N removal, polynuclear aro. sat., high S removal, severe operations | HVGO, VGO, LCO, CGO coker dist., lube stocks | FCC, HC feed pretreat, lubes | Kloverleaf cyl., ext. 4-lobed | 51 | " | NiMo/$MoO_3$ | x |
| **EXXON RESEARCH & ENGINEERING CO.** | | | | | | | | |
| RT-2 | Tailored for resids | Resid | Naphtha, diesel | | | Tailored pore size | CoMo | L |
| -228 | " | " | " | | | | NiMo | L |
| -621 | " | " | " | | | " | CoMo | L |
| RT-3 | Tailored for gas oils | Virgin cracked GOs | " | | | " | CoMo | L |
| TN-8 | " | " | " | | | " | NiMo/CoMo | L |
| **HALDOR TOPSOE** | | | | | | | | |
| TK-551 | High stability | VGO range | Mid. dist., treated VGO | Cyl. | 42 | $Al_2O_3$ | NiMo | x |
| TK-581 | " | " | | " | 42 | " | " | x |
| **ICI KATALCO/ICI CATALYSTS** | | | | | | | | |
| 497 | Combined conver. & HDS act. | Gas oils | Mid. dist. | Katform | 44 | " | CoO/$MoO_3$ | x |
| 499 | Combined conver. & deep HDS act. | " | " | 1/16, 1/8 | 50 | " | " | x |
| 594 | Combined conver. & high HDS, HDN act. | " | " | " | 51 | " | NiO/$MoO_3$ | x |
| 599 | Combined conv. & deep HDS, HDN act. | " | " | " | 57 | " | " | x |
| 545 | " | " | " | " | 50 | " | " | x |
| **PROCATALYSE** | | | | | | | | |
| HTH 544 | Good stab., high mid. dist. selectivity | HVGO | | Cyl. | | $SiO_2/Al_2O_3$ | NiMo | x |
| 546 | | " | | " | | " + promoter | " | x |
| 548 | " | " | | " | " | " | " | x |
| **UNOCAL CORP.** | | | | | | | | |
| HCM-40 | High stab. MHC | Virgin & cracked dist., VGO | Dist. + hot feed hydrotreated | Sh. ext. | "P" | "P" | "P" | L |
| HCM-110 | | | | " | "P" | "P" | "P" | L |
| **UNITED CATALYSTS INC.** | | | | | | | | |
| C20-7-02 | Composition, physical properties | Lube oil, HVGO | Hydrog. olefins, cracked product | Ext. | 44 | $Al_2O_3$ | NiMo | x |
| C20-7-02CDS | | | | " | " | " | " | x |
| C20-7-04 | " | " | " | " | 50 | " | " | x |
| C20-7-06CDS | " | " | " | " | 44 | " | " | x |
| **UOP** | | | | | | | | |
| DHC-2 | Bifunctional clean-up, hdrog., good cracking act. | VGO, CGO | Dist. HDS, lubes | Sph. | 41 | "P" | "P" | x |
| MHC-10 | | " | " | Cyl. | 42 | "P" | "P" | x |

# Hydrotreating/hydrogenation, saturation catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AIR PRODUCTS & CHEMICALS INC.** | | | | | | | | |
| HR 836 | Pretreat | Py gaso. | Sat. hydrocarbons | Cyl. | | $Al_2O_3$ | CoMo | L |
| **AKZO CHEMICALS INC./NIPPON KETJEN (All catalysts available as off-site presulfied, Q = quadralobe)** | | | | | | | | |
| A-540 | Act. suppt., rpl. inert material | All types | | Q | 36 | $Al_2O_3$ | NiMo | x |
| A-541 | " | " | | " | 36 | " | CoMo | x |
| KAS-5B | " | " | | Sph. | 52 | " | NiMo | x |
| AS-20 | " | " | | Q | | " | " | x |
| KG-1 | Descaling/guard | " | | Sph. | | " | " | x |
| KF-H-oil | Ebullating bed | Resid., hvy crude, bitumen | Dist., LSFO | Cyl. | "P" | " | CoMo | L |
| " | " | | " | " | " | " | NiMo | L |
| KFR-10 | Fixed bed | Resid HDM | " | Q | | " | " | x |
| -30 | " | Resid HDM/HDS | " | " | | " | " | x |
| -50 | " | Resid HDS | " | " | | " | " | x |
| -70 | " | " | " | " | | " | " | x |
| KF INT-RI | " | Resid HDM | " | " | | " | " | x |
| KF8-840 | High HDN, HDS, sat. | Naph. to VGO, FCC/HC-PT, lube | | Q | 51 | " | NiMo | x |
| -842 | High HDN/HDS | SR/Cr. naph./CO | | " | 47 | " | " | x |
| -843 | Highest HDN/HDS/aro. sat. | FCC/HC-PT, lube | | " | 56 | " | " | x |
| -844 | High HDS/HDN | Cracked naph. | | " | 47 | " | " | x |
| -845 | " | Naph. to VGO, | | " | 44 | " | " | x |
| -8010 | " | FCC-PT, lube | | Cyl. | 54 | " | " | x |
| -330 | H.P. aro. sat. | Naph. to VGO | | " | 52 | " | NiW | x |
| KF-124 LD | Gen. purp. HDT | SR naph. to dist. | | Cyl. | 38 | " | CoMo | x |
| KF 124 HD | " | " | | " | 48 | " | " | x |
| KF 165 | " | Naph. to HVGO | | " | 48 | " | " | x |
| KF 640 | High HDS act. | Naph. to LGO | | Q | 43 | " | " | x |
| KF-702 | " | Naph. to VGO | | Cyl. | 49 | " | " | x |
| KF-707 | " | " | | " | 48 | " | " | x |
| KF-742 | Deep HDS | Naph. to VGO, | | Q | 45 | " | " | x |
| KF-746 | " | FCC-PT, lube | | " | 37 | " | " | x |
| KF-752 | Highest HDS act. | " | | " | 47 | " | " | x |
| KF-VGO-Demet | HDM of HVGO/DMO/DAO | HVGO/DMO/DAO | | " | 36 | " | " | x |
| KF-901 | High HDS/HDM/MHC | Naph. to VGO | | Cyl. | 47 | " | NiMo/CoMo | x |
| KF-643 | HDM/HDS of resid | Resid | | Q | 39 | " | " | x |

(Continued)

# Hydrotreating/hydrogenation, saturation catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **BASF AG** | | | | | | | | |
| M 8-10 | | Coker benzene | Benzene | Tablets | 0.70* | " | CoO/MoO3 | x |
| M 8-12 | | Naphtha, kero., mid. dist., HGO/VGO | Distillates | Cyl. ext. | 0.70* | " | " | x |
| M 8-14 | | " | " | Star + cyl ext. | 0.75* | " | " | x |
| M 8-21 | | Blend of HGO/VGO w/cracked oils | Mid. dist., FCC feed, lubes | " | 0.70* | " | NiO/MoO3 | x |
| M 8-25 | Aro. hydrogenation | Kerosine | Imprv. smoke pt. | Cyl. ext. | 0.82* | " | " | x |
| M 8-26 | High MON/HDS act., olefin hydrogenation | Naphtha, Kero., mid., dist., VGO, HGO | HC pretreat | Star + cyl. ext. | 0.85* | Special | " | x |
| M 8-30 | | Coker benzene | Benzene | Cyl. ext. | 0.72* | $Al_2O_3$ | MoO3 | x |
| H 0-11 | | Select. hydro. of acetylene in ethylene | Ethylene | " | 0.46* | $SiO_2$ | Pd | x |
| H 0-12 | | Select. hydro. of acetylene in C3-and C4- | | " | 1.1* | $Al_2O_3$ | " | x |
| H 0-22 | | Select. Hydro. of diolefins * unsat. aros. | Py. gaso. + sph. | Cyl. ext. | 0.65-0.80* | " | " | x |
| H 1-80 | | Hydro. of aromatics | Food-grade white oil | Cyl. | 1.0* | $SiO_2$ | Ni | x |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| HDS-2(1.6) | Different particle sizes | Naphthas thru LGO | | Cyl. | 36 | $Al_2O_3$ | $CoO/MoO_3$ | x |
| HDS-2(3.2) | " | | " | " | " | " | x | |
| TRILOBE HDS-3(1.6) | " | " | sh. ext. | " | " | " | x | |
| TRILOBE HDS-3(3.2) | " | " | " | " | " | " | x | |
| HDS-9(1.6) | " | " | " | 49-52 | " | " | x | |
| HDS-9(3.2) | " | " | " | " | " | " | " | x |
| TRILOBE HDS-9(1.6) | " | " | | " | | " | " | x |
| TRILOBE HDS-9(3.2) | " | " | | " | | " | " | x |
| AS-10 | (See Unocal listing) | | | | | | | |
| TRILOBE | Different part. sizes | Naphthas thru HGO | | Sh. ext. | 54 | $Al_2O_3$ | CoO/MoO | x |
| HDN-60(1.6) | " | " | " | " | " | " | " | x |
| HDN-60(3.2) | " | " | " | " | " | " | " | x |
| RT-3 | (See Exxon R & E listing) | | | | | | | |
| IMP-DSD-3 | (See Instituto Mexicano del Petroleo listing) | | | | | | | |
| TRILOBE HDS-24(1.6) | Different part. sizes | Naphthas thru HGO | | Sh. ext. | 35 | $Al_2O_3$ | $CoO/MoO_3$ | x |
| -24(3.2) | " | " | | " | " | " | " | x |
| TRILOBE HDN-34(1.6) | " | " | | " | " | " | $NiO/MoO_3$ | x |
| -34(3.2) | " | " | | " | " | " | " | x |
| RIFLED TRILORE HDS-22(1.6) | " | " | | " | 43 | " | $CoO/MoO_3$ | x |
| HDS-22(3.2) | " | " | | " | " | " | " | x |
| C 214L | Multi-purpose HDT | Naphtha to HVGOs | | Sh. ext. | 0.61 | $Al_2O_3$ | NiMo | x |
| 324 | High perf., HDS, HDN | Coker naphtha & py. | | Cyl. | 0.86* | " | " | x |
| 424 | High act. HDS/HDN, sat. | Pretreat cracker feed | | " | 0.82* | " | " | x |
| C 514 | Support function, replaces inert ceramic material | All HDT applications, preferentially cracked feeds | | Sph. | 0.80* | " | " | x |
| C 344 | Heavy duty HDS | Wide variety of stocks, HVGO | | Cyl. | 0.78* | " | CoMo | x |
| 344T | " | | | Sh. ext. | 0.73* | " | " | x |
| 434 | High eff. desulf. | Naphtha/GO | | Ext. | 0.65* | " | " | x |
| 444 | High activity HDS | VGO/LGO/HGO | | Cyl. | 0.77* | " | " | x |
| 444T | " | cracked GO | | Sh. ext. | 0.72* | " | " | x |
| 447 | Deep HDS | VGO/Resid/LGO, HGO | | " | 0.71* | " | " | x |
| C 544 | Support function, can replace all ceramic material | | | Sph. | 0.80* | " | " | x |
| C127 | Initial residue HDS | Hvy. resid w/moderate metals content | | Cyl. | 0.70* | " | NiMo | x |
| 227 | Tail end deep residue HDS | | | " | " | " | " | x |
| 147 | Initial residue HDS | | | " | " | " | CoMo | x |
| 247 | Tail end residue HDS | " | | " | " | " | " | x |
| 311 | Hydrocracker tail end | Hydrocracked feed | | Sh. ext. | 0.76* | " | NiMo | x |
| C-614 | Hydrog. of aromatics | Kero., speciality oils | | Ext. | 0.41* | $SiO_2/Al_2O_3$ | Pt | x |
| Z 704A | (See Zeolist Enterprises Hydrotreating/hydrogenation listing) | | | | | | | |
| C 204 | Hydrog. of olefins | " | | " | " | $Al_2O_3$ | " | x |
| C 874A | Acetylene to ethylene | | | Cyl. | 0.77* | " | Noble metal | x |
| **ENGLEHARD CORP.** | | | | | | | | |
| HPC-8 | Low density, high pore vol. | Naphtha thru VGO | HDS | Kloverleaf or cyl. | 33 | " | $CoO/MoO_3$ | x |
| -6B | Low density | " | " | | 39 | " | " | x |
| -40B | HDS, HDN | CGO, HVGO, LCO, | FCC feed gaso., jet | " | 47 | " | $NiO/MoO_3$ | x |
| -312 | Actilife base, high act. | Sev. HDS/HDM resid., FCC feed pretrt. | " | | Custom | " | NiMo + "P" | x |
| -416 | " + max. stab. | | | " | | " | " | x |
| -50 | HDS, HDN, PNA sat. | Dist. naphtha, lube | " + lube | " | 51 | " | " | x |
| -70 | High act. HDS/HDN/PNA sat., severe operations | " | FCC feed, HC pretreat, lube | " | 51 | " | " | x |
| -66 | HDS | HS HGO, htg. oil, Hvy. VGO | GO, htg. oil, gaso. | " | 44 | " | $CoO/MoO_3$ | x |
| NI 4352 | High yields | | | " | 59 | $SiO_2/Al_2O_3$ | NiW | x |
| 4342 | " | HC/lube oil finish., aro. sat. naphtha | | " | " | " | " | x |
| -60 | High act. HDS | | " | " | 46 | " | " | x |

(Continued)

# Hydrotreating/hydrogenation, saturation catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **EXXON RESEARCH & ENGINEERING CO.** | | | | | | | | |
| RT-3 | High act., regenerability | Virgin cracked naphthas, dist. | Feed prep. for ref., jet./diesel | | | Tailored pore size | CoMo | L |
| TN-8 | " | | | | | | NiMo/CoMo | L |
| **HALDOR TOPSOE** | | | | | | | | |
| TK-250 | HDS | Gas & Naphtha | Deep HDS, stm. ref. | Ring | 31 | $Al_2O_3$ | CoMo | x |
| -251 | " | " | " | " | " | " | NiMo | x |
| -450 | " | Naphtha | Deep HDS | Cyl. | 32 | " | CoMo | x |
| -451 | " | " | " | " | " | " | NiMo | x |
| -550 | HDN | SR. & Cr. kero. -HVGO" | Deep HDS/HDN | Rng/cyl. | 37-42 | " | " | x |
| -561 | Extra HDN | | " | " | 40-45 | " | " | x |
| **INSTITUTO MEXICANO DEL PETROLEO** | | | | | | | | |
| IMP-DSD-3 | High act. TRILOBE | Petro. fract. | Naphtha, high diesel act., FCC feed | Sh. ext. | 0.74* | $Al_2O_3$ | Mo/Ni/P | L |
| -DSD-4 | High act. sphere | " | | Sph. | 0.55* | " | Mo/Ni | L |
| -DSD-5 | Good act. sphere | Gaso. to diesel HDS | Naphtha, good qual. diesel | " | 0.55* | " | Mo/Ni/P | L |
| -DSD-1 | " | " | | " | 0.86* | " | Mo/Ni | L |
| **ICI KATALCO/ICI CATALYSTS** | | | | | | | | |
| 477S | High pore vol., high resist. 1to $SiO_2$, Pb, aresn. poisoning, HDS | Naphtha blends | Reforming | Sph. | 33 | " | CoO/MoO$_3$ | x |
| 482 | Low density HDS | " + BTX cuts | " | Cyl. | 32 | " | " | x |
| 477 | High HDS | Naphtha thru GOs | Ref./diesel treating FCC feed | Cyl. | 44 | " | " | x |
| 479 | Deep HDS sat., HDN | Dist. thru hvy. GOs | Diesel trtg./FCC fd. | Cyl. | 50 | " | " | x |
| 497 | High HDS | Naphtha thru GOs | " | Katform | 44 | " | " | x |
| 499 | Deep HDS, sat. | Naphtha thru hvy. GOs | " | " | 50 | " | " | x |
| 502S | High pore vol., high resist to $SiO_2$, Pb, arsenic poisoning, HDS, HDN | Naphtha blends | Reforming | Sph. | 33 | | NiO/MoO$_3$ | x |
| 502 | HDS, HDN | " + coker dist. blends | Ref., jet., fuel oil | Cyl. | 44 | " | " | x |
| 504K | High HDS/HDN/sat. | Naphtha thru GO blends, LCO | " + FCC feed | Cyl. | 51 | " | " | x |
| 506 | Deep HDS, HDN, sat. | 100% coker | | " | 58 | " | " | x |
| | | naphtha, hvy. GOs/CGO/LCO resid blnds. lubes | Ref., FCC feed HC feed | " | 57 | " | " | x |
| 592 | HDS HDN | Naphtha blends, coker dist. blends | Ref., jet., fuel oil | Katform | 44 | " | " | x |
| 594 | High HDS, HDN, sat. | Naphtha blnds thru GO blends, LCO | " + FCC feed | " | 51 | " | " | x |
| 535 | High HDS, HDN, sat., low dens. | Naph. blnds. thru GO blnds., LCO | " | " | 42 | " | " | x |
| 545 | Deep HDS, HDN, sat. | Coker naph., naph. blnds thru hvy GOs/LCO | Ref., fuel oil, FCC feed, HC feed | " | 50 | " | " | x |
| 599 | " | Coker feeds, hvy GOs GO & resid blnds, lube | Ref., FCC feed, HC feed | " | 57 | " | " | x |
| 550 | Olefin & aro. sat. | Cracked stocks/ coker stocks, LCO/lube | | Cyl. | 49 | " | " | x |
| 550S | " + low density | | | Sph. | 34 | " | " | x |
| 620 | Demet. catalyst | HGO/VGO resid blnds DTH bed | Demet. feed to main | Cyl. | 35 | "P" | "P" | x |
| **PROCATALYSE** | | | | | | | | |
| LD 271 | Select. hydrog. of propylene rich cut from steam cracking, also butene-1 rich cut | Steam cracker propylene rich, butene-1 rich cut | Propylene, butene-1 | Sph. | | " | Pd prom. | x |
| LD-273 | MAPD removal from FCC $C_3$ cuts | FCC $C_3$ cut | $C_3$ cut | " | | " | " | x |
| 277 | Acetylene removal from butadiene rich steam cracker cut | $C_4$ steam cracker cut | Butadine rich $C_4$ | " | | " | " | x |
| 2773 | " | " | " | " | | " | " | x |
| NiPS2 | Total hydrog. of benzene into cyclohexane | Benzene | Cyclohexane | Powder | | Ni | Ni | x |
| LD 145 | Select. hydrog. of py. gas & 180-400 C. fraction | Py. gas. | Gaso. | " | | " | NiMO | |
| 155 | | " + hvy. gaso. | Gaso., special fuel | " | | " | NiW | |
| 241 | Select. hydrog. of py. gaso. | Py. gaso. | Sweet gaso. | " | | " | Ni | |
| 265 | Select. hydrog. of py. propylene cut, butylene cut, & gaso. | Py. propylene cut, butylene cut gaso. | Propylene, butylene, gaso. | " | | " | Pd | |
| MEP 121 | COS removal | $C_3$ cut | $C_3$ cut | Granules | | Special | | x |
| 191 | Arsenic removal | " | " | Sph. | | $Al_2O_3$ | | x |
| 841 | " | Naphtha | Naphtha to select. hydrogenation | " | | " | | x |
| **UNOCAL CORP.** | | | | | | | | |
| HC-H, HC-K | | | | | | | | |
| AS-100 | Sat of aromatics | Naphtha, kero., jet. | Low aro. naphthas, high smoke pt. kero. jet | Cyl. | "P" | "P" | Noble metal | L |
| **UNITED CATALYSTS INC.** | | | | | | | | |
| C20-5-01 | | SR, coker naphtha, kero. diesel | HDS, removal of metal contaminants imp. color, odor, stab. | Tablet or ext. | 50 | $Al_2O_3$ | CoMo | x |
| C20-6-01 | Composition, physical properties | Lt. naphthas thru hvy. resids. | HDS hydrog. of olefins | Ext. 1/8, 1/16 | 38 | " | " | x |
| -6-03 | | | | | 44 | " | " | x |
| -6-04 | " | | " | | 51 | " | " | x |
| -7-02 | " | Cracked stocks, high olefin, N content feed | HDS/HDN, hydrog. of olefins, de-wax | " | 44 | " | NiMo | x |
| -7-03 | " | | | " | 38 | " | " | x |
| -7-04 | " | | " | Ext. | 50 | " | " | x |
| C20-6-04 CDS | High HDS act. | VGO/LGO/HGO | | " | 37-43 | " | CoMo | x |

(Continued)

# Hydrotreating/hydrogenation, saturation catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| C20-7-07 CDS | High HDS/HDN act. | Pretreat. FCC feed | FCC feed | Ext. | 47-53 | " | NiMo | x |
| G-87 | Total hydrog. of benzene to cyclohexane | Benzene | Cyclohexane | Sph. | 52-58 | | Ni | x |
| -98B | | Benzene w/S | " | Tablet | 48-52 | $SiO_2$ | Ni/Cu/Co | x |
| C46-7-03 | High hdrog. activity | Aro. sat. | | Ext. | 40-48 | " | Ni | x |
| -8-03 | " | " | | Ext. | " | $Al_2O_3$ | Ni | x |
| G-68A | Hydrog. of $C_5$ dienes | Isoprene | | Tablet | 32-48 | " | Pd | x |
| G-68C | Select. hydrog. DPG-diolefins | Py. gaso. | Gaso. | Sph. | 42-48 | " | " | x |
| G-68D | Select. hydrog. trace butadiene & isom. $B_1$ to $B_2$ | $C_3$ - $C_4$ stream | Alky. feed | Tablet | 64-69 | " | " | x |
| C38-1 | Select. hydrog. trace butadiene with isomerization | $C_3$ - $C_5$ stream with S | " | Ext. | 52-58 | $Al_2O_3$ | Ni | x |
| C20-7-06 CDS | | | " | " | 44 | " | NiMo | x |
| **UOP** | | | | | | | | |
| S-12 | High HDS, HDN | Naphtha cracked stocks, high severity | HDS, HDN | Cyl. | 49 | " | CoMo | x |
| PF-4 | Select. hydrog. | Alpha-meta-styrene in Cumene. diolefin sat.- | Cumene, py. gaso. | Sph. | 32 | " | Pd | |
| H-3 | High hydrog. act., S tolerant | Aro. sat (usually benzene) | High-purity cycloparaffins (usually cyclohexane) | " | 32 | " - | Pt | |
| H-4 | High hydrog. act. | " + select. diolefin sat., methane | "plus upgrade alky feed" | " | 44 | " | Ni | |
| H-8 | " | Aro sat. dist., sat. of resid. aros. in n- paraffin streams | Imp. burning or ign. qualities, high purity n-paraffins | Sph. | 32 | " | " | |
| **ZEOLIST ENTERPRISES** | | | | | | | | |
| Z-704A | Hydrog. of PCA & Mono-aros. in S and N containing feeds | Fuels, solvents, lubes | Low aro. prods. | Ext. | "P" | Mole sieve | Noble metal | Contact Criterion |

# Hydrorefining catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC./NIPPON KETJEN (All catalysts available as off-site presulfided)** | | | | | | | | |
| HC-K | (See Unocal hydrorefining listing) | | | Q | "P" | "P" | NiMo | L |
| Rf-100, 200, 220 | (See Unocal hydrorefining listing) | | | | | | | L |
| RT-2, 3, 4, 228, 621, NX-1, TN-8 | (See Exxon Research & Engineering Hydrorefining liting) | | | | | | | L |
| **BASF AG** | | | | | | | | |
| M 8-24 | Lube hydrofinishing | Raw lube feed | Lube, white oil | Cyl. ext. | 0.72* | $Al_2O_3$ | Nio/$MoO_3$ | x |
| M 8-25 | Wax HDT, paraffins | Slack wax | Food gr. paraffin | " | 0.82* | " | " | x |
| H 1-80 | White oil | Aro. hydrog. | Med grd. wht. oil | " | 1.0* | "P" | NiO | L |
| **CATALYST & CHEMICALS INDUSTRIES CO., LTD.** | | | | | | | | |
| CDS-R2 | High HDS, low reaction temp. | Atm. & vac. resid | Desulf. oil | Cyl. | 0.68* | $Al_2O_3$ | | x |
| -R9 | High HDS & demet. | " | " | " | 0.66* | " | | x |
| -R25-HT | " | " | " | " | 0.63* | " | | x |
| -DM-1 | High demet. | " | Demetallized oil | " | 0.58* | " | | x |
| -DM-5 | High demet., with HDS | " | " | " | 0.62* | " | | x |
| CDS-D5 | High HDS activity | Naphtha & kero. | Deslf. napht., kero. | " | 0.68* | | | x |
| -D9 | " | " + gas oil | Deslf. kero., VGO | " | 0.72* | $Al_2O_3$ | | x |
| -D11 | " | Kero., diesel VGO | Deslf. kero., diesel, VGO | " | 0.73* | | | x |
| -D13 | Superior high HDS act. | " | | " | 0.78* | | | x |
| -D15 | " | " | " | " | 0.73* | | | x |
| CDS-DN1 | High HDS/HDN activity | Naphtha | Desulf. naphtha | " | 0.77* | $Al_2O_3$ | | x |
| **CHEVRON RESEARCH CO.** | | | | | | | | |
| ICR 112 | High HDS act., low $H_2$ consumpt. | VGO, CGO | LSFO, FCC feed | " | 42-54 | "P" | "P" | L |
| 114 | High HDN activity | " | FCC feed | "P" | " | "P" | "P" | L |
| 105 | For resid HDS | DAO, topped crudes, atm., vac. resids | LSFO, FCC feed, coker feed | Cyl. or Sh | 40-48 | "P" | "P" | L |
| 131 | Low cost resid HDS | | | Sh. ext. | 30-38 | " | " | L |
| 121 | Resid feeds | | " | " | 34-42 | "P" | "P" | L |
| 122 | Resid HDM | " | " + resid HDS feed | Sph. | 28-38 | "P" | "P" | L |
| 132 | " + high act. | " | " | Sh. ext. | 30-38 | "P" | "P" | L |
| GC-101 | High metals resistant | HDS, atm., vac, resid | 0.5-1.0% SHFO | Cyl. | 30-40 | $Al_2O_3$ | "P" | L |
| -106 | " | | " | " | " | " | "P" | L |
| -102 | High coke deact. resistant | HDS amt., vac. resids" | 0.2-0.6% S HFO, resid, FCC feed prep | Cyl. sh. ext. | 33-41 | " | "P" | L |
| -107 | HDS cat. | | | | " | " | "P" | L |
| -100 | High sev. resid HDS | " | 0.05-0.2% S HFO | " | 33-42 | " | "P" | L |
| -105 | " | " | " | " | " | " | "P" | L |
| -125 | Metals resistant . | High metals atm./ vac. resids | Demet./HDS | " | 30-37 | " | "P" | L |
| -130 | " | | " | " | " | " | "P" | L |
| GC-405 | High act., hydrog., select HC | Conventional refined | Lube, base oils | " | 40-48 | " | "P" | L |
| GC-36 | High act. hydro., select. HC | Poor quality lube feed | " | Cyl. | 50-55 | $SiO_2$, $Al_2O_3$ | "P" | L |
| -30 | Higher activity | | " | " | 50-60 | " | "P" | L |
| -26 | Selective hydrogenation | Semi-refined lube, speciality oil product feed | Lube indust. oils, speciality products | " | 60-70 | $Al_2O_3$ | "P" | L |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| HC-B, HC-D | (see Unocal Hydrc efining listing) | | | | | | | |
| TRILOBE HC-C, HC-H | | | | | | | | |
| TRILOBE RF-11, RF-25 | | | | | | | | |

(Continued)

# Hydrorefining catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| Rt-2, RT-3 | (See Exxon Research & Engineering hydrorefining listing) | | | | | | | |
| CSM-471 | | Resid HD | | Sh. ext. | "P" | "P" | "P" | L |
| HDS-1442-A | Different particle sizes | Resid or VGO HDT | | Cyl. | 34 | $Al_2O_3$ | CoO/$MoO_3$ | x |
| -1442-B | " | " | | " | " | " | " | x |
| -1443-A | " | " | | " | " | " | NiO/$MoO_3$ | x |
| -1443-B | " | " | | " | " | " | " | x |
| HDS-9(1.6) | Diff. part. sizes & shapes | HGO/cat. feed HDT | Fuel oil/FCC feed | Cyl. or | 49-52 | " | " | x |
| 9(3.2) | " | " | " | sh. ext. | " | " | " | x |
| GC-100,101, 102, 105, 106, 107 | (See Chevron Research Co. hydrorefining listing) | | | | | | | |
| GC 405, 36, 30, 26 | " | | | | | | | |
| TRILOBE HDN-60(1.6) | Different particle sizes | HGO/cat. feed HDT | Fuel oil/FCC feed | Sh. ext. | 54 | $Al_2O_3$ | NiO/$MoO_3$ | x |
| -60(3.2) | " | " | " | " | " | " | " | x |
| N-21, -22, -23, -30 | (See Unocal hydrorefining listing) | | | | | | | |
| RIFLED TRILOBE HDS-22(1.6) | Different particle sizes | HGO/cat. HDT | | Sh. ext | 50 | $Al_2O_3$ | NiO/$MoO_3$ | x |
| 22-(3.2) | " | " | | " | " | " | " | x |
| CSM-481 | | HGO thru resid | | Sh. ext. | "P" | "P" | "P" | L |
| 482 | | " | | " | " | " | " | L |
| CDM-152 | | " | | " | " | " | " | L |
| TRILOBE HDS-22(1.6) | Different particle sizes | Fuel oil, FCC feed | | " | 43 | $Al_2O_3$ | CoO/$MoO_3$ | x |
| -22(3.2) | " | " | | " | " | " | " | x |
| C 214i | Multipurp. HDT | Naphtha to HVGO | | " | 0.6* | " | NiMo/P | x |
| 324 | High perf. HDS, HDN | Coker naphtha, py. gaso. to HVGO | | " | 0.86* | " | " | x<br>x |
| 424 | High act. HDS, HDN, Sat. | Pretrt. of cracker feed, 1st stg. HC | | " | 0.82* | " | " | x |
| 514 | Suppt. function, repl. ceramic matl. | All HDT applications pref. crcked fd. stks. | | Sph. | 0.80* | " | NiMo | x |
| 344 | Hvy. duty HDS | Wide var. of feed including HVGO | | " | 0.75* | " | CoMo/P | x |
| 344T | " | " | | Sh. ext. | 0.70* | " | CoMo/P | x |
| 434 | High eff. HDS | Naphtha, GO | | Ext. | 0.65* | " | CoMo | x |
| 444 | High act. HDS | VGO/LGO/HGO cracked GOs | | " | 0.77* | " | " | x |
| 444T | " | | | " | 0.72* | " | " | x |
| 544 | Suppt. function, replaces ceramic material | All HDT apps. | | Sph. | 0.80* | " | | x |
| 127 | Intial resid HDS | Hvy. resid, | | Ext. | 0.70* | " | NiMo | x |
| 277 | Tail end deep resid HDS | Mod. metals | | " | " | " | " | x |
| 311 | HC tail end catalyst | HC feed & naphthas | | " | 0.76* | | " | x |
| 614 | Hydrog. of aros. | Kero * Spec. oils | | " | 0.41* | SiO2/$Al_2O_3$ | Pt | x |
| Z 704A | " | " | | | | | | |
| **EXXON RESEARCH & ENGINEERING CO.** | | | | | | | | |
| RT-2 | Contaminant toler. for resid | Atm./vac. resids | Diesel, LSFO | | | Tailored pore | CoMo., | L |
| -228 | proc., high act., regen. | virgin/cracked | FCC feed prep. | | | size | NiMo | L |
| -621 | " | GOS | coking | | | " | CoMo | L |
| -3, | " | " | FCC feed prep. | | | " | " | L |
| TN-8 | " | " | LSFO | | | " | NiMo/CoMo | L |
| **HALDOR TOPSOE** | | | | | | | | |
| TK-550 | High HDS act. | Virgin cr. kero. to | HDS | Rgn/cyl. | 35-40 | $Al_2O_3$ | CoMo | x |
| -551 | High HDN act. | HVGO | " | " | 37-42 | " | NiMo | x |
| -561 | Highest HDN act. | " | HDS/HDN/PNA | " | 40-45 | " | " | x |
| -709 | Low HDS/high HDM/high met. tol. | Amt./vac. resid | HDM | Ring | 25 | " | Mo | x |
| -710 | Med. HDS/high HDM/high met. tol. | " | " | Rng/Cyl. | 31-38 | " | CoMo | x |
| -711 | " | " | " | " | " | " | NiMo | x |
| -750 | Good HDS/mod. HDM & met. tol | " | HDS/HDM | " | " | " | CoMo | x |
| -751 | " | " | HDM | " | " | " | NiMo | x |
| -770 | High HDS/low HDM & met tol. | " | HDS | Cyl. | 40 | " | CoMo | x |
| -771 | " | | " | " | 42 | " | NiMo | x |
| -753 | Reduced sludge formation | Resid | Hydrocracking | " | 37 | " | NiMo | x |
| **INSTITUTO MEXICANO DEL PETROLEO** | | | | | | | | |
| IMP-HDW-10 | Zeolitic for dewax. lube oil cuts | Wide lube range | Dewaxed lube | Cyl. | 0.80* | Zeo. $Al_2O_3$ | Pt/zeo. | L |
| **ICI KATALCO/ICI CATALYSTS** | | | | | | | | |
| 477 | High HDS | Gas oils | Fuel oils, FCC fd. | Cyl. | 44 | $Al_2O_3$ | CoO/$MoO_3$ | x |
| 479 | Deep HDS, HDN, sat. | Hvy. GOs | " | " | 50 | " | " | x |
| 497 | High HDS | Gas oils | " | Katform | 44 | " | " | x |
| 499 | Deep HDS, HDN, sat. | Hvy. GOs | " | " | 50 | " | " | x |
| 504K | High HDS, HDN, sat. | GO blends | " | Cyl. | 51 | " | NiO/$MoO_3$ | x |
| 506 | Deep HDS, HDN, sat. | GO & resid blnds. | " | " | 57 | " | " | x |
| 594 | High HDS, HDN, sat. | GO blends | " | Katform | 51 | " | " | x |
| 535 | High HDS, HDN, sat. low density | " | " | " | 42 | " | " | x |
| 545 | Deep HDS, HDN, sat. | Hvy. GOs, GO & resid blends | " | " | 50 | " | " | x |
| 599 | Deep HDS, HDN, sat. | " | " | " | 57 | " | " | x |
| KAT 4000 | Ebullated bed HDS | Resid | | Cyl. | 34 | " | CoO/$MoO_3$ | x |
| 5000 | " | " | | " | 34 | " | NiO/$MoO_3$ | x |
| RT-2<br>-3 | (See Exxon Research & Engineering hydrorefining listing) | | | | | | | |
| GC-101 | (See Chevron Research Co. hydrorefining listing) | | | | | | | |
| -102, 106, 107 | " | | | | | | | |
| **PROCATALYSE** | | | | | | | | |
| HR 306 | HDS, HDN | Naphtha thru VGO | | Cyl. | | $Al_2O_3$ | CoMo | x |

(Continued)

# Hydrorefining catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| 308 | HDT | Residues | " | " | 0.67* | " | " | x |
| 346 | HDS/HDN/aro. hydrogenation | " | " | " | " | " | NiMo | x |
| 348 | " | Naphtha thru VGO | Desulf. N-free product | " | 0.77* | " | " | x |
| 354 | " | " | N-free product | " |  | " | NiW | x |
| HMC 841 | HDT, HDM | GO/VGO/atm., vac resid |  | Sph. |  | " | NiMo | x |
| 849 | HDM | " |  | " |  | " | " | x |
| 845 | HDT, HDM | " |  | " |  | " | " | x |
| Actisphere 923 | Catalyst protection & support | Naphtha thru resid |  | " |  | " | NiMo/CoMo | x |
| **UNOCAL CORP.** |  |  |  |  |  |  |  |  |
| N-30 | High act., HDS | Virgin, cracked, dist. naphthas, VGOs | Desulfurized products | Sh. ext. | “P” | “P” | CoMo | L |
| -100 | " |  |  | Cyl. | “P” | “P” | " | L |
| -23 | " | " | " | " | “P” | “P” | " | L |
| -22 | HDS, HDN | " | Low S, N prods. | " | “P” | “P” | NiMo | L |
| -21 | " | " | " | " | “P” | “P” | " | L |
| HC-H | HDS, HDN | " | HC, FCC Feed | Sh. ext. | “P” | “P” | " | L |
| HC-K | " | " | " | " | “P” | “P” | " | L |
| HC-F | " | " | Dist. prods. HC/FCC feed | " | “P” | “P” | " | L |
| HC-D | " | " |  | " | “P” | “P” | " | L |
| HC-B | " | " | " | " | “P” | “P” | " | L |
| RF-11 | HDS | Atm. resid., whole crudes | Fuel oil, FCC coker feed | Sh. ext. | “P” | “P” | “P” | L |
| RF-25 | High act. bifunctional demet. |  |  | " | “P” | “P” | “P” | L |
| RF-100 | HDS | " | " | " | “P” | “P” | “P” | L |
| RF-200 | High act. bifunctional demet. | " | " | " | “P” | “P” | “P” | L |
| RF-220 | " | " | " | " | “P” | “P” | “P” | L |
| **UOP** |  |  |  |  |  |  |  |  |
| RCD-5 | Metals tolerance, HDS | Atm. or vac. resid. | LSFO, cracking, coker feed | Sph. | 41 | $Al_2O_3$ | CoMo | Contact UOP |
| -5A | High act. for HDS, mod. metal | " |  | " | 46 | " | " |  |
| -7 | High act. for S and CCR removal | Demet oil, DA resid. | LSFO, cracking feed | Cyl. | 53 | " | " | " |
| -8 | High metals toler., high demet. mod HDS act. | Atm., vac. resid. DA resid | LSFO cracking, coker feed | " | 36 | “P” | “P” | " |
| -9 | High metals toler., high demet., high HDS act. | " | " | " | 37 | “P” | “P” | " |

# Polymerization catalysts

|  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| **INSTITUTO MEXICANO DEL PETROLERO** |  |  |  |  |  |  |  |  |
| IMP-TPC-1 | High selective extrudate | Propylene | Propylene tetramer, high oct. gaso. | Cyl. | 0.88* | Kieselgurgh | $H_3PO_4$ | L |
| **UNITED CATALYSTS INC.** |  |  |  |  |  |  |  |  |
| C84-01-01 | Particle size | Propylene, benzene, butenes | Cumene polygaso. higher olefins | Sph. | 55 | Diatomaceous earth | $H_3PO_4$ | x |
| C-02-04 | " |  |  | " | " |  | " | x |
| C-3-01 | Form, particle size | " | " | Ext. | " | " | " | x |
| -03-02 | " | " | " | " | " | " | " | x |
| T-2466A | Polygas, higher olefins |  |  | Ext. | 55 | “P” | " | x |
| **UOP** |  |  |  |  |  |  |  |  |
| SPA-1 | High act. & select. larger size chamber reactor | Propylene, butenes, pentenes, benzene, toluene | Petrochemicals, gaso., tetramer, cumene, cymene | Cyl. | 58 | $SiO_2$ | $H_3PO_4$ | Contact UOP |
| -2 | Small size for tubular reactor |  |  | " | " | " | " | " |

# Sulfur (elemental) recovery catalysts

|  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| **ALCOA** |  |  |  |  |  |  |  |  |
| S-100 1/4" | Lower pressure drop | Claus feed | Withstands pressure drop due to coking & $NH_3$. All converters and subdew point tail gas processes. | Sph. | 45 | Activated $Al_2O_3$ | Activated $Al_2O_3$ | x |
| S-100 3/16" | Higher activity | Ref. or nat. gas | All converters & sub dew pt. tail gas processes | " | " | " | " | x |
| S-100 5/16" | Ext. low pressure drop |  | Withstands extreme coking & $NH_3$ | Sph. | 45 | " | " | x |
| SP-100 3/16" | Promoted, lower pressure drop | High COS & $CS_2$ conversion | COS and $CS_2$ conv., withstands fouling due to cracking of aromatics. | " | 47 | Activated $Al_2O_3$ | “P” | x |
| SP-100 | Promoted | High COS and $CS_2$ conv. | " | " | " | " | “P” | x |
| SRU 1/2"<br>3/8" | Active bed supt., high physical strength | All Claus plants | High strength bed suppt. and hold down with Claus activity | " | 50 | " | Activated $Al_2O_3$ | x |
| **ARI TECHNOLOGIES** |  |  |  |  |  |  |  |  |
| ARI-310 | Active ingredient in chelated aqueous solution | Ref. gas, SWS gas, amine tail gas, nat. gas | Elemental S | Liquid | 74.8 | None | Fe | L |
| **CATALYST & CHEMICALS INDUSTRIES CO. LTD.** |  |  |  |  |  |  |  |  |
| CSR-2 | High Claus activity | Claus react. feed gas | S | Sph. | 0.84* | $Al_2O_3$ |  | x |
| CSR-3 | High hydrolysis of org. sulfide |  | " | " | 0.87* | " |  | x |
| CSR-7 | High prevention of sulfation | " | " | " | 0.80* | " |  | x |

(Continued)

# Sulfur (elemental) recovery catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| S 949 | High act. Claus, high $COS/CS_2$ hydrolysis | | S | Sph. | 0.53* | $SiO_2$ | | x |
| **ENGELHARD CORP.** | | | | | | | | |
| SuReCat 2-4, 3-6 | High act., low attr. prom. S resist. | Gas w/2:1 $H_2S/SO_2$ | Purified gas, S | Sph. | 50-52 | " | Al, Ti, Fe oxide | x |
| SRC 2-4 | High Claus activity | " | " | Granules | 53 | " | " | x |
| 4-8 | Higher than SRC 2-4 activity | | " | " | 55 | " | " | x |
| LPD 5-16 | Modest activity, bed support | " | " | Ext. | 52 | " | " | x |
| LPD 5-8 | Modest activity, bed support only | " | " | " | 52 | " | " | x |
| **LA ROCHE CHEMICAL CO.** | | | | | | | | |
| S-301 3x6 | High porosity, high act., | $H_2SCO_2/COS/CS_2$ | S | Sph. | 45 | Activated | Activated | x |
| 1/2x1/4 | lowest attrition | conv. | " | " | " | $Al_2O_3$ | $Al_2O_3$ | x |
| S-201 3x6 | Stand. high porosity | $H_2SCO_2/COS/CS_2$ | " | " | " | " | " | x |
| 1/2x1/4 | " | conv. | " | " | " | " | " | x |
| S-200 3x6 | Low attr., mod. $CS_2$ conv. act. | $H_2$ & $SO_2$ conv. | " | " | 48 | " | " | x |
| 1/2x1/4 | " | " | " | " | " | " | " | x |
| S-501 3x6 | Promoted, sulfation resistant | Imp. $COS/CS_2$ conv. | " | " | 52 | " | " | x |
| 1/2x1/4 | " | " | " | " | " | " | " | x |
| S-701 | " + thermal stability | Very high $CS_2/COS/H_2S$ conversion | " | Kloverleaf | 52 | " | " | x |
| **RHONE POULENC** | | | | | | | | |
| CR 4-6 | High pore volume | $H_2S$ | S | Sph. | 0.67* | $Al_2O_3$ | | x |
| DR 5-10 | First generation Claus | " | " | " | 0.75* | " | | x |
| AM 4-6 | Sulfation protection | " | " | " | " | " | Fe | x |
| CRS 21 | High COS, & $CS_2$ conv. | " | " | " | 0.71* | " | $TiO_2$ | x |
| CRS 31 | High $COS/CS_2$ conv., unsulfatable | " | " | Cyl | 0.95* | $TiO_2$ | $TiO_2$ | x |
| CT 739 | Catalytic incineration | $H_2S$ & $SO_2$ | $SO_2$ | Sph. | 0.60* | $SiO_2$ | Fe | x |
| **UNOCAL CORP.** | | | | | | | | |
| Selectox-32 | Solid for oxidation of $H_2S$ to S | Ref. acid gas, nat. gas plants, or waste treatment plants. | S, no $SO_3$ | Cyl. | "P" | "P" | Non-noble metals | L |
| Selectox-33 | " | " | | " | " | " | " | L |

# Steam hydrocarbon reforming catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **BASF AG** | | | | | | | | |
| M 8-12 | Hydrog. of organic S compounds | Nat. ref. gas/ LPG, lt. naphtha | Steam reformer feed | Ext. | 0.72* | $Al_2O_3$ | CoMo | x |
| M 8-21 | " | High $CO_2$ | " | " | " | " | NiMo | x |
| R 5-10 | Removal of $H_2S$ | S containing gas | " | " | 1.2* | " | ZnO | x |
| 10-20 | Removal of chlorine | $Cl_2$ containing gas | " | Sph. | 0.80* | " | Promoted | x |
| G 1-25 | Steam ref. (gasification) | Nat./ref. gas | " | Rings | 1.1-1.25* | " | Ni | x |
| 1-25I | " | " | " | " | " | " | Promoted | x |
| 1-25S | " + high therm. stab. | " | " | " | 0.95-1.1* | " | Ni | x |
| G 1-50 | Steam ref. (gasification) | LPG/naphtha | " | " | 1.1* | | Ni alkalized Spec. carrier | x |
| 1-12/1 | " (sek. reformer) | Nat./ref. gas | " | " | 1.0* | " | Ni | x |
| 1-26 | " | " | " | " | 1.1* | " | " | x |
| 1-80 | Autothermal steam reforming | " | Proc. gas tub. ref. | Tablets | "P" | "P" | Ni | L |
| K 6-10 | High temp. shift conv. | Proc. gas, ex. stm. ref., partial oxid. | Proc. gas for $H_2$ production | " | 1.0* | | Fe/Cr oxide | x |
| 6-11 | " (low S/C ratios) | " | " | " | 1.1* | | prom. FE/Cr ox | x |
| 3-110 | Low temp. shift conv. | Proc. gas ex. HTS | " | Tablets | 1.15* | $ZnO/Al_2O_3$ | Cu | x |
| 8-11 | Shift conversion, $H_2S$ cont. gas | Proc. gas ex. partial oxidation | " | Ext./tabs | "P" | "P" | CoMo | x |
| **DYCAT INTERNATIONAL** | | | | | | | | |
| Dycat 101 | S removal | Nat. gas | | Granules | 0.50* | | Carbon | x |
| 120 | Acid gas scavenger | Tail gas, Polyprop. | | Gran. ext. | 0.85* | | Soda lime | x |
| 140 | S removal | Gas, naphtha | S-free hydrocarbons | Sph. | 70 | None | ZnO | x |
| Dycat 873 | High act. steam reforming | Nat./ref. gas | $H_2/CO/CO_2$ | Rings | 68-70 | $Al_2O_3$ | Ni, La | x |
| 873F | " | LPG, lt. naphtha | " | Enhanced | 64-66 | " | " | x |
| 890 | " | Naphtha, gas | " | rings | 68-70 | " | " | x |
| 504 | High temp. shift conv. | Proc. gas, ex stm. ref., part. ox. | Proc. gas, $H_2$ prod. | Tablets | 1.25* | | Fe, Cr oxides | x |
| 804 | Methanation | $CO/CO_2$ | " | Rings, | 54-56 | Refractory | " | x |
| 844 | " | High C oxide gas | $H_2$ | Tablets | 0.70* | | Ni, La | x |
| **HALDER TOPSOE** | | | | | | | | |
| HTZ-3 | Fine desulf of stm ref. feed | $CH_4$/LPG/naphtha, ref. gas | S-free hydrocarbs. | Ext. | 81 | | ZnO | x |
| -5 | " | | " | " | 62 | | " | x |
| TK-250 | HDS | Gas & naphtha | Deep HDS, stm. ref. | Rings | 31 | $Al_2O_3$ | CoMo | x |
| -251 | " | " | " | " | " | " | NiMo | x |
| -450 | " | Naphtha | " | Cyl. | 32 | " | CoMo | x |
| -451 | " | " | " | " | " | " | NiMo | x |
| HIG-1 | $Cl_2$ absorption/HC offgases | Downstrm. HDS | | Ring | 58 | | $Al_2O_3$ | x |
| RK-69 | High act. stm. ref. alkalai promoted | $C_1$-$C_4$ HC ref. gas | | " | 65-68 | $MgAl_2O_4$ | Ni | x |
| -69 7H | " | " | | 7-hole rng | 57-60 | " | " | x |
| R-67 | High act. stm. ref. | " | | Ring | 65-68 | " | " | x |
| -67-7H | " | " | | 7-hole rng | 57-60 | " | " | x |
| RKNR | " | $CH_4$/LPG/naph. lt/hvy. offgas | | Rings | " | " | " | L |

(Continued)

# Steam hydrocarbon reforming catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| SK-12 | High temp. CO conversion | Stm. ref. eff. | 2-3% CO gas | Cyl. | 69 | | Fe/Cr oxides | x |
| -201 | " + high act., no byprod. formation at low S/C ratio | " | " | " | " | | | x |
| KK-142 | " + high act. even at low S/C ratio | " | " | " | 75 | | Cu oxides | x |
| LSK | Low temp. Co conv., regen $Cl_2$ resist | HT shift effluent | 0.1-0.3% CO gas | " | 66 | | Cu/Zn/Cr ox. | x |
| LK-801 | Low temp. CO conv., S resistant | " | " | " | 62 | | Cu/Zn/Al ox. | x |
| -821 | " + high act. & long life | " | " | " | " | | " | x |
| PK-5 | Methanation | $H_2$, 2% CO + $CO_2$ | $H_2$ w/o $CO/CO_2/O_2$ contain, contaminatins | Rings | 39 | $Al_2O_3$ | Ni | x |
| **ICI KATALCO/ICI CATALYSTS** | | | | | | | | |
| 41-6 | HDS | Gas/naphtha | | Ext. | 0.6* | $Al_2O_3$ | CoMo | x |
| 61-1 | " | " | | " | 0.67* | " | NiMo | x |
| 32-4 | S removal | " | | Sph. | 1.08* | None | ZnO | x |
| 25-3 | " | Hvy. gas | | " | 1.0* | " | $NiK_2O$ | x |
| 59-3 | Chloride removal | " | | " | 0.85* | $Al_2O_3$ | Alkali | x |
| 46-1 | Steam reforming | Naphtha | | Ring | 1.15* | " | $NiK_2O$ | x |
| 46-4 | " | " | | " | 1.0* | $Ca/Al_2O_3$ | Ni | x |
| 57-3 | " | Nat./ref gas | | " | 1.0* | " | | x |
| 23-1,23-3 | Steam reforming | Nat./ref. gas | | Ring | 66/75 | $Al_2O_3$ | Ni | x |
| 23-4, 23-4M | " | " | | 4 hole rng | " | " | " | x |
| 25 series | " | Hvy. nat. gas | | Raschig & 4 hole rng. | 66 | Ca, $Al_2O_3$ | $NiK_2O$ | x |
| 46-9 | " | " + LPGs | | Ring | " | " | " | x |
| 71-1 | High temp shift | Reformer prod. gas | | Cyl. | 77 | None | Fe/Cr oxides | x |
| 52-2 | Low temp shift | HT shift prod. gas | | " | 62 | | $Cu/Zn/Al_2O_3$ | x |
| 53-1 | " | " | | " | " | " | " | x |
| 11-3 | Methanation | $CO_2$ removal | | " | 70 | Ca, $Al_2O_3$ | Ni | x |
| 11-4 | " | " | | " | 75 | " | " | x |
| **UNITED CATALYSTS INC.** | | | | | | | | |
| C11-2, -2S | Steam reforming | Nat. gas-$C_3H_3$ feed | $H_2$, 65-72% | Raschig rings | 50-65# | Ca, $Al_2O_3$ | Ni | x |
| C11-9-01 to 04/06 | Composition differs | " | " | rings | 70-95# | Refractory | " | x |
| C11-09 HGS | " | " | " | Wheels | 70 | $Al_2O_3$ | " | x |
| G90A, B, C | " | " | " | Raschig rings | 50-60# | " | " | x |
| G56A, B, H | " | " | " | Raschig rings | 55-60# | Ca, $Al_2O_3$ | " | x |
| G-91 HGS | High act., K promoted | | | Ring/whls | 50 | Refractory | " | x |
| C11-9-061 | " | $C_4H_{10}$/naphtha | " | " | 80-85# | Refractory | " | x |
| C11-9-062 | " | " | " | "or HSGA" | (70 HSGA) | $Al_2O_3$ | " | x |
| C11-N/C11-NK | " and split loading | " | " | Rasching rings | 67 | " | " | x |
| # Bulk density depends on size of rings and Ni content. | | | | | | | | |
| C7-2 | Desulf., metal content | NG steam ref. feed | S free streams | Ext. | 70 | Binder | ZnO | x |
| -4 | " | | | " | 80 | " | " | x |
| G-72D | " | " | " | " | 70 | " | " | x |
| G-1 | Conv. of S compounds to $H_2/H_2S$ absorption | NG streams | " | Tablets | "P" | "P" | "P" | x |
| C12-3-05 | High temperature shift conv. | Proc. gas ex. reformer | CO-free gas | " | 65 | | Fe/Cr | x |
| G3 | " | | " | " | 70 | | Fe/Cr | x |
| C18 HC | Low temp. shift conv. | Process gas | " | " | 80-85 | | Cu | x |
| HCS | " | " | " | " | 70-80 | | " | x |
| G66A | " | " | " | " | 80 | | " | x |
| 66B | " | " | " | " | 90/85 | | " | x |
| C13-3 | Methanation (diff. form & metal content) | " | $H_2$ w/o $CO/CO_2$ | " | 65 | Refractory | Ni | x |
| -4 | | " | " | Sph. | 55 | " | " | x |
| -5 | " | " | " | " | 60 | " | " | x |
| C25-2-02 | $CO/H_2O$ shift, $H_2S$ containing gas | Proc. gas/part. ox | " | Ext. tabs | 40-47 | $Al_2O_3$ | CoMo | x |
| G65 | | " | | Tablet | | " | " | x |
| G65RS | Withstands elevated temp. | | | Ext. tab. | 58(ex)60(T) | | | |
| G87 | Methanation | " | | Ext. | 60 | " | " | x |
| 87RS | " | " | | Sph. | 55 | " | " | x |
| **PROCATALYSE** | | | | | | | | |
| MT 15 | CO methanation | | Pure $H_2$ | Sph. | | " | Ni | x |

# Sweetening catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ARI TECHNOLOGIES** | | | | | | | | |
| ARI-100 | Slurry of act. metal | LPG, gaso. | Merox, Mericat/iq/lq | Powder | | None | "P" | x |
| -100L | " | " | " | Liq. susp. | | " | " | x |
| -100EXL | Solution of act. metal | " | " | Liquid | | " | "P" | x |
| -120 | Powder | LPG/gaso./kero/jet | Merox fixed bed | Powder | | " | | x |
| 120L | Slurry of act. metal | " | " | Lq. slurry | | " | | x |
| **ICI KATALCO/ICI CATALYSTS** | | | | | | | | |
| 75-1 | Gas phase $H_2S$ removal | NG, ref. gas., reformate | | Sph. | 52 | | ZnO | x |
| 85-1 | Liq. phase $H_2S$ removal | LPG/NGL/kero. gaso./lubes | | " | 52 | | " | x |
| **INSTITUTO MEXICANA DEL PETROLEO** | | | | | | | | |
| IMP OM-1 | Sweet in homogenous phase | LPG, gaso. | | Powder | | | Co | L |
| OM-2 | Sweet in heterogenous phase | Gaso., turbine fuel | | " | | | " | L |
| **PROCATALYSE** | | | | | | | | |
| LCPS 30 | Act. agent dissolved in water | LPG, gaso., jet. | | Liquid | | | "P" | x |
| **UOP** | | | | | | | | |
| MEROX FB | Active agent dispersed in water | Lt. nap. to diesel | Merox, fixed bed | Lq. slurry | | | "P" | L |

(Continued)

# Sweetening catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| MEROX WS | " | $C_1$ through LSR, gaso. | Merox, liq/liq. | Liquid sol. | | | "P" | L |
| MEROX No. 10 | Active agent supported on activated carbon | Lt. nap. to diesel | Merox | Granular | | Activated carbon | "P" | L |
| MEROX No. 8 | | " | " | " | | " | " | |

# Claus unit tail gas treatment catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC./NIPPON KETJEN (All catalysts available as off-site presulfided)** | | | | | | | | |
| KF-124 LD | | | | Cyl. | 38 | $Al_2O_3$ | CoMo | x |
| KF-124 HD | | | | " | 48 | " | " | x |
| KF 165 | | | | Cyl. | 48 | " | " | x |
| **ALCOA** | | | | | | | | |
| S-100 1/8" | Sub dew pt. Claus tail gas | | | Sph. | 46 | | None | x |
| **ARI TECHNOLOGIES** | | | | | | | | |
| ARI-310 | Active ingredient in chelated aqueous solution | Claus tail gas, amine acid gas | Elemental S | Liquid | 74.8 | None | Fe | L |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| N-25, N-39 | (See Unocal Claus unit listing) | | | | | | | |
| HDS-2 | | Tail gas | | Cyl. | 36 | $Al_2O_3$ | $CoO/MoO_3$ | x |
| Selectox-33 | (See Unocal Claus unit listing) | | | | | | | |
| C 099 | (Inciner. of Claus, SCOT tail gas | Claus, SCOT tail gas | | Sph. | 0.78* | $Al_2O_3$ | | x |
| 599 | Suppt. funct., rpl. ceram. matl | | | " | 0.53* | " | | x |
| 234 | Conv. of S compounds to $H_2S$ | Claus tail gas | | Cyl. | 0.77* | " | CoMo | x |
| 534 | " | " | | Sph. | 0.77* | " | " | x |
| **ICI KATALCO/ICI CATALYSTS** | | | | | | | | |
| 403 | $COS/CS_2$ conv., high stab. | Claus tail gas | $H_2S$ to recycle | Cyl. | 32 | " | $CoO/MoO_3$ | x |
| **LA ROCHE CHEMICALS** | | | | | | | | |
| S-301 3x6 | High porosity, low attrition | Sub dew pt. Claus tail gas | | Sph. | 45 | Activated $Al_2O_3$ | Activated $Al_2O_3$ | x |
| 5x8 | " | | | " | " | | | x |
| S-201 3x6 | Std. high porosity alumina | " | | " | " | " | " | x |
| 5x8 | " | " | | " | " | " | " | x |
| S-701 | Promoted sulfur recovery | High $CS_2$/COS conv. | TGCU process | Kloverleaf | 52 | "P" | "P" | x |
| **PROCATALYSE** | | | | | | | | |
| TG 103 | Tot. hydrog. of S compounds | Claus tail gas | $H_2S$ | Sph. | 0.75* | $Al_2O_3$ | CoMo | x |
| 105 | " | " | " | " | " | " | " | x |
| **RHONE POULENC** | | | | | | | | |
| A 2.5 | Catalysts for Sulfreen | Claus effluent | | Sph. | 0.77* | $Al_2O_3$ | | x |
| CRS 31 | Oxidation of $H_2S$ to S | " | | Ext. | 0.95* | $TiO_2$ | | x |
| AM 2.5 | Catalyst protection (Sulfreen) | " | | Sph. | 0.82* | $Al_2O_3$ | Fe | x |
| **UNOCAL CORP.** | | | | | | | | |
| Selectox-33 | Solid for oxidation of $H_2S$ to S | Claus tail gas | | Cyl. | "P" | "P" | Non-noble metals | L |
| Selectox-32 | catalytic incineration of $SO_2$ | " | | " | "P" | "P" | " | L |
| N-25 | Hydrolysis of gas S compounds | " | | " | "P" | "P" | "P" | L |
| N-39 | " | " | | " | "P" | "P" | "P" | L |
| N-239 | " | " | | " | " | " | CoMo | L |
| **UNITED CATALYSTS INC.** | | | | | | | | |
| C29-2-02 | | Claus tail gas | | Ext. | 37 | $Al_2O_3$ | CoMo | x |
| -2-03 | Stabilized carrier(SC) | " | | " | " | " | " | x |
| -2-04 | SC + lower metals | " | | " | " | " | " | x |
| -3-03 | SC + spherical form (SF) | " | | Sph. | 55 | " | " | x |
| -3-304 | SC, SF + lower metals | " | | " | 50 | " | " | x |
| -4-03 | Composition, SC, SF | " | | " | 55 | " | NiMo | x |
| N-239 | (See Unocal Corp., Claus unit Listing | | | | | | | |
| G-41P | COS hydrolysis | High $CS_2$/COS conv. | | Ext. | 34-38 | $Al_2O_3$ | "P" | x |

# Other refining catalysts

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC.** | | | | | | | | |
| K-25 | Octane improver, attr. resist. | High oct., high LPG olefinicity | High oct. gaso. | Powder | | $SiO_2/Al_2O_3$ | ZSM-5 | x |
| **BAYER AG** | | | | | | | | |
| OC-1038 | Hydrog. & etherification, condensation, dehydrolization | Methanol & $C_5$ cracked fraction, acetone | TAME<br>MIBK | Beads | 1.2* | Polystyrene DVB | Sulfonic acid groups, Pd | L |
| AC-10FT | Oligomerization | Isobutene | Di/tri-isobutene | Powder | 1.3* | copolymersate | | L |
| **BP** | | | | | | | | |
| CDW-12 | Product of specialty/lube oils | Dist./raffinate | High quality specialty, lube oils | Cyl. | | Zeolite | Noble metal | L |
| -14 | Imp. low temp. properties of mid distillates | Kero., gas oils | Jet, kero., diesel, heating oils | " | | " | " | L |
| FF-62 | Lube oil color improvement | Solvent ref. lubes | Finished lubes | Sph. | | "P" | "P" | L |
| **CHEVRON RESEARCH CO.** | | | | | | | | |
| GC-500 | Selective arsine removal | Lt. HC gas | Arsine free feed | Cyl. | 34-35 | $Al_2O_3$ | "P" | L |
| -501 | " | " | " | " | " | " | " | L |
| **CRITERION CATALYSTS CO. LP** | | | | | | | | |
| TSR-10 | (See Unocal "other" listing) | | | | | | | |
| SOAR-100 | " | | | | | | | |
| C 538 | $CO/H_2O$ shift reactors | Treatment of syngas | | Sph. | 0.82* | $Al_2O_3$ | CoMo | x |
| **ENGELHARD CORP.** | | | | | | | | |
| HZ-1 | Gas oil cracking, Houdriflow TTC. HZ-1 is octane catalyst | HGO | Olefins, LPG, LCO | Ext. | 0.95* | In situ zeo. | Zeo./no RE | x |

(Continued)

# Other refining catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| HZ-PLUS | High attrition resistant | " | " | " | " | " | " | x |
| EMCAT-100 | RE exchanged version, max. liq. yield, HCC, TOC xylenes + | HGO/toluene/ mixed $C_9$ transalky | LPG/gaso/LCO xylene, benezene | " | " | " | Zeo. RE exchanged | x |
| EMCAT-80 | Lower activity version | " | " | " | " | " | " | x |
| HZ-PLUS P | Prepromoted products for max. CO burning. | HGO cracking | LPG/gaso/LCO | " | " | " | Zeo. no RE | x |
| EMCAT-100 P | " | " | " | " | " | " | Zeo RE exch. | x |
| HRD-264 | Vapor phase S removal | Naphtha reformer | S-free naphtha | " | 70 | $Al_2O_3$ | "P" | x |
| NI 3238 | Liq. phase S removal | " | " | Cyl. | 50 | " | Ni | x |
| **HALDOR TOPSOE** | | | | | | | | |
| HTZ-3 | Fine desulfur. of steam ref. feed | Methane/LPG/ naphtha, ref. gas | S-free hydro-carbon | Ext. | 81 | | ZnO | x |
| HTZ-5 | + low temp., low S | " | " | " | 62 | | " | x |
| TK-250 | HDS | Gas & naphtha | Deep HDS/stm. ref. | Rings | 31 | $Al_2O_3$ | CoMo | x |
| -251 | " | " | " | " | " | " | NiMo | x |
| -450 | " | Naptha | " | Cyl. | 32 | " | CoMo | x |
| -451 | " | " | " | " | " | " | NiMo | x |
| HIG-1 | $Cl_2$ absorption from HC offgases | Downstrm. HDS | | Ring | 58 | | $Al_2O_3$ | x |
| RK-69 | High act. stm. ref., alkalai promoted | $C_1$-$C_4$ HCs, ref. gas | | " | 65-68 | $MgAl_2O_4$ | Ni | x |
| -69-7H | | " | | 7-hole rng | 57-60 | " | " | x |
| R-67 | High act. stm. ref. | " | | Rings | 65-68 | " | " | x |
| -67-7H | " | " | | 7-hole rng | 57-60 | " | " | x |
| RKNR | " | $CH_4$/LPG/naph/ hvy offgas | | Rings | " | " | " | x |
| SK-12 | High temp. CO conv. | Steam ref. effluent | Gas w/2-3% CO | Cyl. | 69 | | Fe/Cr oxides | x |
| -201 | " + high act., no byprod. formation at low S/C ratio | " | " | " | " | | " | x |
| KK-142 | " + high act. even at low S/C ratio | " | " | " | 75 | | Cu oxides | x |
| LSK | Low temp. CO conv., regen., chlorine resistant | HT-shift effluent | Gas with 0.1-0.3% CO" | | 66 | | Zn, Cr oxides | x |
| LK-801 | " | " | " | | 62 | | Cu,Zn,Al ox. | x |
| -821 | " + high act., long life | " | " | " | 62 | | " | x |
| PK-5 | Methanation | $H_2$ w/o $CO/CO_2$, up to 2% contaminants | | Rings | 39 | $Al_2O_3$ | Ni | x |
| **ICI KATALCO/ICI Catalysts** | | | | | | | | |
| 75-1 | Cold desulf. of gaseous HCs | NG/naphtha/ $H_2$ off gas/ | $H_2S$ free HCs | Sph. | 52 | | ZnO | x |
| 85-1 | Cold desulf. of liquid HCs | LPG/NGL/kero./ lube oils | " | " | 52 | | " | x |
| 59-3 | HCl removal | NG/$H_2$ offgas/cat. ref. | Chloride free HCs | " | 52 | $Al_2O_3$ | Activated | x |
| 32-4 | Desulf. of steam ref. feed | $CH_4$/LPG/naphtha/ ref. gas | $H_2S$-free HCs | Sph. | 75 | | ZnO | x |
| **INSTITUTO MEXICANO DEL PETROLEO** | | | | | | | | |
| IMP-TPC-1 | Cumene production | Benzene, propane propylene | Cumene | Cyl. | 0.86-0.95* | | Fe/K, oxides | L |
| IMP-ES-1 | Styrene production | Ethylbenzene | Styrene | Cyl. | 1.0-1.4* | | " | L |
| **INTERCAT CORP.** | | | | | | | | |
| V-CAT | Attrition resisitant additive to selectively demobilize Vanadium | | | MS | | Separate addition via feed system | | |
| BCA-105 | Selectively cracks hvy. cycle oil into LCO and gasoline | | | MS | | Blend with FCC catalyst | | |
| **KALI-CHEMIE AG** | | | | | | | | |
| KC PERL-KATOR series | Moving bed cat. cracking in TCC, Houdriflow | Gas oils | | Beads | | $SiO_2/Al_2O_3$ | Acid sites | L |
| D 1 | Hvy. feeds, gaso. yields secondary | HGO/VGO | $C_3/C_4$ olefins | " | 0.80* | $SiO_2$, $Al_2O_3$ | Amorphous alum. silicate | x |
| D8 | Imp. yield select. more gas., less avg. gas & coke | " | 7050, dist. | " | 0.90* | " | " | x |
| D9A | High act. version imp. stab. | " | " | " | " | " | " | x |
| D10A | Max. Co burning in kiln gas CO combustion promoter | " | " | " | " | " | " | x |
| D 11 | High octane | " | High oct. gaso. | " | " | " | " | x |
| D 12 | High gaso. selectivity | " | " + low coke low coke yields | " | " | " | " | x |
| D 14 | " | " | High oct. gaso. | " | " | " | " | x |
| XP-catalyst | Xylenes-plus process | Transalky, disproportionation of toluene | Xylenes/benzene | " | " | " | RE exch. zeo. | L |
| Beadcat PK series | Xylenes Isom. | Xylenes | p, o-xylene | " | 0.8* | " | Acid sites | x |
| **PROCATALYSE** | | | | | | | | |
| RS 103 | Oxidation of S compounds | S-$H_2S$/COS/ $CS_2$/RSH | $SO_2$ | Sph. | | $Al_2O_3$ | Metallic oxides | x |
| FF 62 | Lube oil hydrofinishing | Extracted lube | Finished base oil | Sph. | | " | | L |
| HR 346 | Wax hydrotreating | Slack wax | Food grade wax | Cyl. | | " | NiMo | x |
| **UNOCAL CORP.** | | | | | | | | |
| TSR-10 | Trace S removal | Naphthas | Cat. ref. feed | Sh. ext. | "P" | "P" | "P" | L |
| TSR-11 | " | " | " | " | "P" | "P" | "P" | L |
| SOAR-100 | Arsenic removal | Shale oil, coal liq. | Low arsenic prod. | " | "P" | "P" | "P" | L |
| **UNITED CATALYSTS** | | | | | | | | |
| C53-2-01 | COS hydrolysis | FCC P-P gas | | Ext. | 28-32 | $Al_2O_3$ | PTS | x |
| G-132 | Arsine removal | " | | Tab | 75-85 | | Cu | x |
| C28-1-01 | S removal | Naphthas, cat. ref. feed | | Ext. | 45-50 | "P" | "P" | x |

(Continued)

# Other refining catalysts—continued

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc | Carrier, support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| TSR-11 | (See Unocal "other" listing) | | | | | | | L |
| C125-1-01 | HCl removal | $H_2$ offgas cat. ref. | | Ext. | 47-53 | Zn | Ca | x |
| G-92 | " | " | | Sph. | 49-55 | $Al_2O_3$ | Na | x |
| **UOP** | | | | | | | | |
| TA-4 | Transalkylation | Toluene and $C_9$ aro. | Benzene, xylenes | Cyl. | 45 | "P" | "P" | Contact |
| DEH-5 | Paraffin dehydro. | $C_6$-$C_{20}$ paraffins | $C_6$-$C_{20}$ mono-olefins | Sph. | 21 | $Al_2O_3$ | Pt | UOP |
| DEH-6 | Lt paraffin dehydrog. | $C_3$-$C_5$ paraffins | $C_3$-$C_5$ mono-olefins | " | " | " | "P" | " |
| DEH-7 | Paraffin dehydrog. | $C_6$-$C_{20}$ n-paraffins | $C_6$-$C_{20}$ mono-olefins | " | 20 | " | "P" | " |
| A-2 | Alkyl. of benzene w/ethylene | Ethylene, benzene | Ethylbenzene | " | 35 | $Al_2O_3$ | "P" | " |

# Methyl tertiary butyl ether (MTBE) catalysts

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **BAYER AG** | | | | | | | |
| K2611 | Etherification | Methanol/$C_4$ raffinates | Beads | 1.2* DVB copoly-merisate | Polystyrene | Sulfonic acid groups | L |

# Combustion Promotors (FCC)

| Catalyst designation | Primary differentiating characteristics | Application | Additive to or component of catalyst | Form | Carrier, support | Active agents | Available |
|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC.** | | | | | | | |
| KOC-15 | High SA stability | CO combustion | | Powder | $SiO_2/Al_2O_3$ | Pt | x |
| -18 | " | " | | " | " | " | x |
| **AMBUR CHEMICAL CO. INC.** | | | | | | | |
| CCA-1 | Highest activity bimetallic | CO combustion | Additive | MS | HiPur. $Al_2O_3$ | Pt., Pd | x |
| -8 | High activity, bimetallic | " | " | " | " | " | x |
| -6 | Medium act., bimetallic | " | " | " | " | " | x |
| -850 | Highest act., monometallic | " | " | " | " | Pt | x |
| -700 | High act., monometallic | " | " | " | " | " | x |
| -500 | Medium act., monometallic | " | " | " | " | " | x |
| -350 | Lower act., monometallic | " | " | " | " | " | x |
| **CATALYSTS & CHEMICALS INDUSTRIES CO. LTD.** | | | | | | | |
| SP-10S | Solid CO combustion promoter | FCC feed | Additive | Sph. | $Al_2O_3$ | "P" | x |
| **DAVISON CHEMICAL DIVISION, W.R. GRACE & CO.** | | | | | | | |
| CP-3 | High activity | Partial comp. CO comb | Additive | MS | "P" | "P" | x |
| -5 | " | " | " | " | "P" | "P" | x |
| CPA | " | " | " | " | "P" | "P" | x |
| **ENGELHARD CORP.** | | | | | | | |
| COCAT-1 | Low activity | Partial CO comb. | Additive | MS | $SiO_2/Al_2O_3$ | Prec. metal | x |
| -5 | High activity | Comp. CO comb. | " | " | " | " | x |
| PROCAT 500 | " | " | " | " | " | " | x |
| COCAT-7 | High act., imprvd. support | " | " | " | " | " | x |
| PROCAT 700 | " | " | " | " | " | " | x |
| **FILTROL CORP.** | | | | | | | |
| FILTROX A | Low activity | CO combustion | Additive | MS | $SiO_2/Al_2O_3$ | Pt | x |
| C | Med. activity | " | " | " | " | " | x |
| H | High activity | " | " | " | " | " | x |
| **INTERCAT CORP.** | | | | | | | |
| COP-850 | Pt. content | CO combustion | Additive | MS | $Al_2O_3$ | Pt | x |
| -550 | " | " | " | " | " | " | x |
| -350 | " | " | " | " | " | " | x |
| **KATALISTIKS INTERNATIONAL** | | | | | | | |
| KCP-800 | Act. in high severity appls. | Par/full CO comb. | Add. or blend | " | " | Prec. metals | x |
| -801 | Low severity operations | additive or blend | " | " | " | " | x |
| **UOP** | | | | | | | |
| UNICAT CI-3 | Active metal | CO combustion | Additive | Powder | $Al_2O_3/SIO_2$ | Pt | x |
| **W.R. GRACE CATALYSTS PTY. LTD. (See Davison Chemical Co. combustion promoter listing)** | | | | | | | |

# Sulfur oxides reduction catalyst (FCC)

| Catalyst designation | Characteristics | Form | How introduced to FCC system |
|---|---|---|---|
| **AZKO CHEMICALS INC.** | | | |
| KDSOX | Low regenerator SOX,emissions, attrition resistance | Powder | Additive |
| **CHEVRON RESEARCH CO.** | | | |
| Transcat | Fully fluidizable powder | Added to FCC cat. | Separate add. to FCC |
| **DAVISON CHEMICAL DIV. W. R. GRACE** | | | |
| Soxtrap-520 | Reduces regen flue gas SOx emissions | MS | Solid additive which can be added separately or pre-blended with FCC catalyst |
| **ENGELHARD CORP.** | | | |
| ULTRASOX | Typical FCC particle | Typical FCC cat. | As fresh makeup |
| MAGNASIV 370S | " | " | " |
| **INTERCAT CORP.** | | | |
| LO-SOX | Attrition resistant additive to control SOx emissions | MS | Separate additive via INTERCAT addtive feed system |
| **KATALISTIKS INTERNATIONAL** | | | |
| DESOX | Removes SOx from FCC flue gas, releases as $H_2S$ | MS | Added or blended with FCC catalyst |
| **W.R. GRACE CATALYSTS PTY. LTD. (See Davison Chemical Division SOx listing)** | | | |

# Catalysts available from East Germany

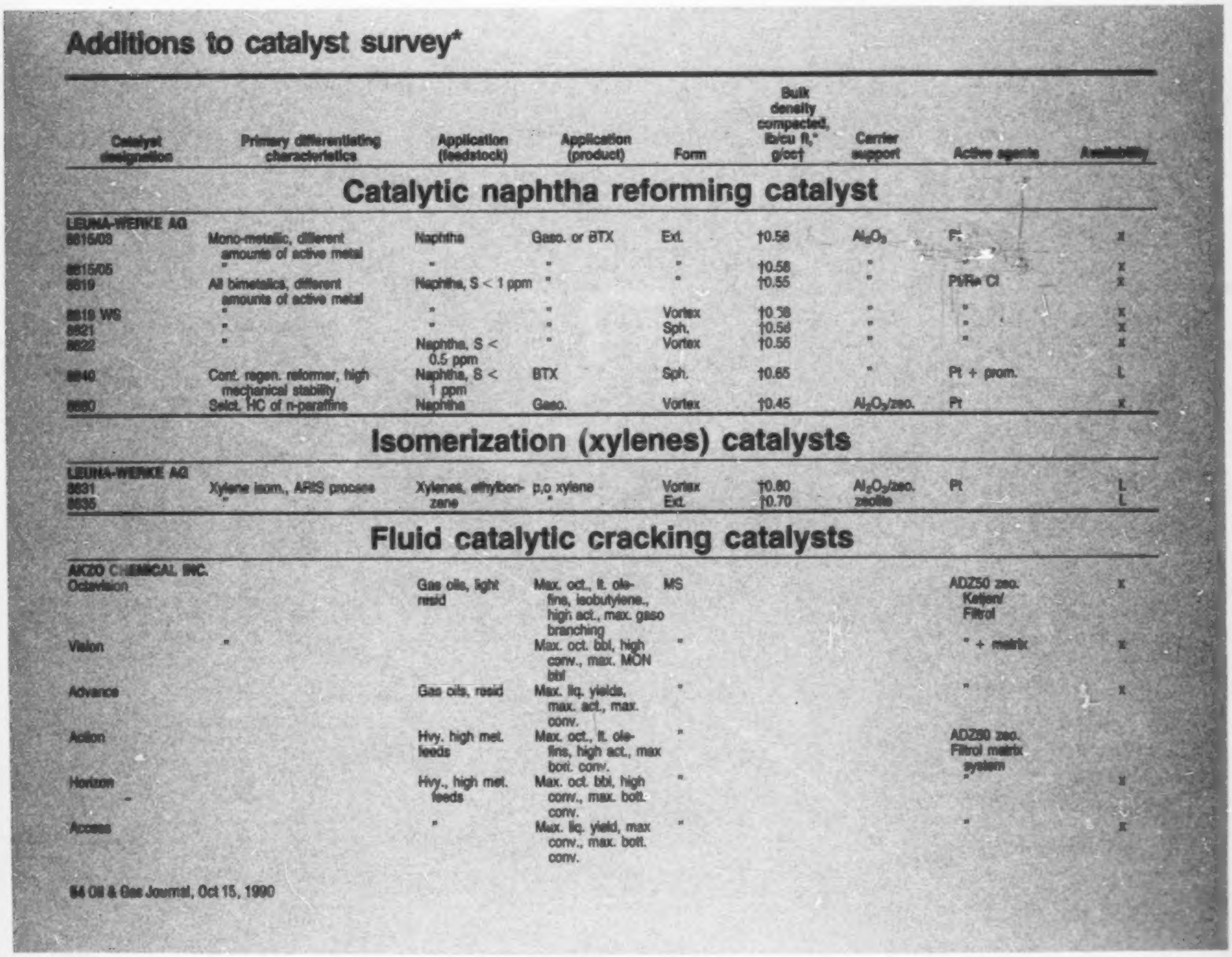
Catalysts manufactured in East Germany join the Journal's annual refining catalyst compilation for the first time.

Leuna-Werke AG of Leuna, East Germany, manufactures catalytic reforming, hydrocracking, mild hydrocracking, hydrotreating, and hydrorefining catalysts, among others.

The company offers almost 50 catalysts for these processing categories. The Leuna-Werke listings came too late for the OGJ annual catalyst report on Oct. 1 (see table). Also too late to make the report are new FCC catalysts offered by Akzo Chemicals Inc.

### East German listing

Like all the refining enterprises in East Germany, Leuna-Werke is restructuring from a state-planned economy to a free market operation (see OGJ, Oct. 1, p. 46). The ultimate objective is to make a profit. As a result, Leuna is actively promoting the sale and licensing of its catalysts. The company has had a catalyst research and development program under



## Additions to catalyst survey*

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **Catalytic naphtha reforming catalyst** | | | | | | | | |
| LEUNA-WERKE AG | | | | | | | | |
| 8815/03 | Mono-metallic, different amounts of active metal | Naphtha | Gaso. or BTX | Ext. | †0.56 | $Al_2O_3$ | Pt | x |
| 8815/05 | " | " | " | " | †0.58 | " | " | x |
| 8819 | All bimetalics, different amounts of active metal | Naphtha, S < 1 ppm | " | " | †0.55 | " | Pt/Re Cl | x |
| 8819 WS | " | " | " | Vortex | †0.58 | " | " | x |
| 8821 | " | " | " | Sph. | †0.58 | " | " | x |
| 8822 | " | Naphtha, S < 0.5 ppm | " | Vortex | †0.56 | " | " | x |
| 8840 | Cont. regen. reformer, high mechanical stability | Naphtha, S < 1 ppm | BTX | Sph. | †0.65 | " | Pt + prom. | L |
| 8860 | Selct. HC of n-paraffins | Naphtha | Gaso. | Vortex | †0.45 | $Al_2O_3$/zeo. | Pt | x |
| **Isomerization (xylenes) catalysts** | | | | | | | | |
| LEUNA-WERKE AG | | | | | | | | |
| 8831 | Xylene isom., ARIS process | Xylenes, ethylbenzene | p,o xylene | Vortex | †0.80 | $Al_2O_3$/zeo. | Pt | L |
| 8835 | " | | " | Ext. | †0.70 | zeolite | | L |
| **Fluid catalytic cracking catalysts** | | | | | | | | |
| AKZO CHEMICAL INC. | | | | | | | | |
| Octavision | | Gas oils, light resid | Max. oct., lt. olefins, isobutylene., high act., max. gaso branching | MS | | | ADZ50 zeo. Ketjen/ Filtrol | x |
| Vision | " | | Max. oct. bbl, high conv., max. MON bbl | " | | | " + matrix | x |
| Advance | | Gas oils, resid | Max. liq. yields, max. act., max. conv. | " | | | " | x |
| Action | | Hvy. high met. feeds | Max. oct., lt. olefins, high act., max bott. conv. | " | | | ADZ50 zeo. Filtrol matrix system | |
| Horizon | | Hvy., high met. feeds | Max. oct. bbl, high conv., max. bott. conv. | " | | | " | x |
| Access | | " | Max. liq. yield, max conv., max. bott. conv. | " | | | " | x |

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# Additions to catalyst survey—(continued)

## Hydrocracking catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **LEUNA-WERKE AG** | | | | | | | | |
| 9514 | High selectivity | Unrefined VGO | Mid. dist., HC paraffins | Cloverleaf twisted vortex | †0.50 | $Al_2O_3/SiO_2$ | $NiOMoO_3$ | x |
| 9522 | In comb. with 9914 | " | " | " | †0.50 | " + zeo. | " | x |
| 9526 | Higher hydrog. act. than 9514 | Visbreaker VGO | HC paraffin | Tab. | †0.75 | " | NiO $WO_3$ | x |
| 9534 | High pressure applications | Unrefined mid. dist. | Gaso., comp. DO | Tab. | †0.70 | Zeolite | " | x |
| 9536 | " | " + AGO | " | Ring tab. | †0.65 | Zeolite | CoO $WO_3$ | x |
| 9562 | Select. HC of n-paraffins | Naphtha fractions | Gaso. | Sph. | †0.55 | Zeolite | Pt | x |
| 9573 | Hydrodewaxing | Refined mid. dist., AGO | DO, imp. cloud pt. | Cloverleaf | †0.70 | " | $NiOWO_3$ | x |
| 9580 | In comb. with 9526 | Visbreaker VGO | HC paraffins | Tab. | †0.75 | $Al_2O_3/SiO_2$ | " | x |

## Mild hydrocracking catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **LEUNA-WERKE AG** | | | | | | | | |
| 8270 | High hydrog. and HDN activity (Desus process) | VGO, HGO | DO | Vortex | †0.70 | $Al_2O_3$ | $NiOMoO_3$ | x |

## Hydrotreated/hydrogenation, saturation catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **AKZO CHEMICALS INC.** | | | | | | | | |
| KF-542 | Act. suppt. to repl. inert matl. | All types | | Q | 36.00 | $Al_2O_3$ | NiCoMo | x |
| KF-1301 | HDC in ebullulated bed, highest CCR conversion | Resid, hvy. crudes, bitumen, etc. | Syncrude, dist, LSFO | Cyl. | P | P | P | x |
| KF-1302 | HDC in ebullated bed, improved sediment control | Resid, hvy. crudes | Dist. LSFO | Cyl. | P | P | P | x |
| KF-852 | Highest aro. reduction | Dist., VGO, low aro. | | Q | P | P | P | x |
| **LEUNA-WERKE AG** | | | | | | | | |
| 6524 | Hydrog. of benzene to cyclohex. | Benzene | Cyclohexane | Tab. | †0.65 | $Al_2O_3$ | Ni | x |
| 7741 | Select. hydrog. of ethane | $C_2$ front-end | Ethene | Tab. | †0.90 | " | Pd + Prom. | L |
| 7751 | Select. hydrog. of propane and propadiene | $C_3$ tail-end fractions | Propene | Sph. | +1.00 | " | " | L |
| 7752 | In comb. with 7751 | " | " | Tab. | †0.92 | " | Pd | L |
| 7762 | Select. hydrog. of styrene and dienes (2st stage) | Py. gaso. | Gaso. or aromatics | Ext. | †0.55 | " | Pd | x |
| 8203 | HDS, hydrog. of alkenes (2 stg) | HDT, py. gaso. | Gaso. or aromatics | Ext. | †0.65 | " + $SiO_2$ | $NiOMoO_3$ | x |
| 8203 HS | Descaling/guard | Diff. HC fractions | Feed for HDS | Ring. ext. | †0.50 | " | " | x |
| 8213 | Guard/As removal | " | " | Ring | †0.55 | $Al_2O_3$ | " | x |
| | | | | Twisted | †0.60 | | | x |
| 8214 | Guard/HDM | Hvy. HC fractions | DMO | Twisted | †0.50 | " | " | x |

## Hydrorefining catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **LEUNA-WERKE AG** | | | | | | | | |
| 8196 | Repl. ceram. mtl. by catalyst | DO, VGO | HDS fractions | Ring, tab. | †0.80 | $Al_2O_3$ | $NiOMoO_3$ | x |
| 8207 | HDS, HDN (DESUS process) | VGO | FCC feed | Vortex | †0.70 | " | " | x |
| 8208 | HDS, HDM (DESUS process) | SRGO, DO, VGO | HDS fractions | Vortex | †0.60 | " + $SiO_2$ | " | x |
| 8211 | HDS | Naphtha, kero. | " | Sph. | †0.65 | $Al_2O_3$ | " | x |
| 8221 S | HDS, HDN, PCA decomp. | VGO, deasphalting | Lube oils | Ext. | †0.60 | $Al_2O_3/SiO_2$ | " | x |

## Sulfur (elemental) recovery catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **LEUNA-WERKE AG** | | | | | | | | |
| 6303 | 2nd and 3rd cat. stage | Claus feed | Sulfur | Sph. | †0.50 | $Al_2O_3/SiO_2$ | $Al_2O_3/SiO_2$ | x |
| 6304 | High $COS/CS_2$ hydrolysis | " | " | " | †0.50 | " | $Al_2O_3$ + prom. | x |

## Steam hydrocarbon reforming catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **LEUNA-WERKE AG** | | | | | | | | |
| 8203 | Hydrog. of organic S compounds to $H_2S$ | Nat. gas, syn. gas | Stm. ref. feed | Ext. | †0.65 | $Al_2O_3/SiO_2$ | $NiOMoO_3$ | x |
| 8203 HS | " | " | " | Ring ext. | †0.50 | " | " | x |
| 4013 | " + removal of $H_2S$ | " | " | Tab. | †1.45 | ZnO | ZnO + prom. | x |
| 4015 | Removal of $H_2S$ | " | " | " | †1.30 | " | ZnO | x |
| 4016 | Removal of HCl + $H_2S$ | " | S & Cl free HC | " | †1.20 | " | ZnO + prom. | x |
| 1031 | High temp. CO conv. | Proc. gas ex. stm. reformer, part. oxid. | Gas for $H_2/NH_3$ prod. | " | †1.30 | | Fe/Cr oxides | x |
| 1963 | Low temp. CO conv. | | " | " | †1.45 | | Cu/Cr/Al/Zn Ox | x |
| 6540 | Methanation, low temp. | " | " | " | †1.05 | | Ni, Ni/Cr Ox | x |
| 6542 | " + higher temp., stab. | " | " | " | †1.15 | | Ni, Ni/Cr/Al oxides | x |
| 6543 | Higher temp. methanation | " | | | | | | |

## Claus unit tail gas treatment catalysts

| Catalyst designation | Primary differentiating characteristics | Application (feedstock) | Application (product) | Form | Bulk density compacted, lb/cu ft,* g/cc† | Carrier support | Active agents | Availability |
|---|---|---|---|---|---|---|---|---|
| **LEUNA-WERKE AG** | | | | | | | | |
| 6311 | Removal of $H_2S$ & $SO_2$ | Claus tail gas | S | Sph. | †0.50 | $Al_2O_3$ | Prom. | x |

*These catalysts were submitted too late for inclusion in the Annual Catalyst Report, Oct. 1, 1990, p. 49.

**Abbreviations for catalyst compilation**

**ABD**—Apparent bulk density; **AGO**—Atmospheric gas oil; **ARO.**—Aromatic or aromatics; **BTX**—Benzene, toluene, xylenes (aromatics); **Cet.**—Cetane; **CGO**—Coker gas oil; **Cyl.**—Cylinder; **DAO**—Deasphalted oil; **Dist.**—Distillate or distillates; **DMO**—Demetallized oil; **DO**—Diesel oil; **Ext.**—Extrudate; **FCC**—Fluid catalytic cracking or FCC unit; **GO**—Gas oil; **Gaso.**—Gasoline; **HAGO**—Heavy atmospheric gas oil; **HC**—Hydrocracking or hydrocracked; **HDM**—Hydrodemetallization; **HDN**—Hydrodenitrogenation; **HDS**—Hydrodesulfurization; **HDT**—Hydrotreating or hydrotreated; **HFO**—Heavy fuel oil; **HGO**—Heavy gas oil; **HSFO**—High sulfur fuel oil; **HVGO**—Heavy vacuum gas oil; **Jet.**—Jet fuel; **Kero.**—Kerosine; **LCO**—Light cycle oil; **LGO**—Light gas oil; **LSFO**—Low sulfur fuel oil; **LSR**—Light straight run; **MHC**—Mild hydrocracking; **MS**—Microsphere; **Oct.**—Octane; **'P'**—Proprietary; **Prom.**—Promoted or promoter; **RE**—Rare earth; **RDS**—Residual desulfurization; **SA**—Surface area; **SR**—Straight run; **Stab.**—Stable or stability; **Sph.**—Sphere; **Sh. ext.**—Shaped extrudate; **VGO**—Vacuum gas oil; **Zeo.**—Zeolite; **x**—Unrestricted availability; **L**—Available under license only

# *Worldwide Construction*

**Lou Ann Thrash**
Director of Editorial Surveys

Major construction projects in worldwide processing and pipelining, showing capacities, contractors, estimated costs, and time of completion. Total capacity figure in "Remarks & completion" column includes capacity of project listed.

## Refineries — WORLDWIDE CONSTRUCTION

*Designates projects listed for the first time in the Journal.

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| UNITED STATES | | | |
| American International Petroleum Corp.—Lake Charles, La. | Vacuum | 16,500 | |
| Amoco Oil—Whiting, Ind. | Alky | .... | Upgrade. Litwin, BMW. 1990. |
| Texas City, Tex. | Vacuum | .... | Upgrade. Litwin. 1990. |
| | Hydrogen | .... | Recovery. Contr: Air Products. |
| Mandan, ND. | Cat Crack | .... | Regenerator cyclone replacement. Contr: Stone & Webster. |
| Yorktown, VA. | Cat Reform | .... | Ultraformer upgrade. |
| ARCO—Ferndale, Wash. | Expan. | 3,000 | Delayed Coker. Engr: Parsons. Contr: Bechtel. 1990. |
| Los Angeles | Revamp | .... | Resid Reprocessing. Engr: Jacobs. March 1991. |
| *Bellingham, Wa. | Upgrade | .... | diesel hydrotreater. |
| Ashland Petroleum— | | | |
| Catlettsburg, Ky. | Hydrotreater | 40,000 | Process: Foster Wheeler. Sept. 1993. |
| St. Paul, Minn. | Hydrotreater | 20,000 | Process: Foster Wheeler. Sept. 1993. |
| Canton, Ohio | Hydrotrearer | 20,000 | Process: Foster Wheeler. Sept. 1993. |
| BP Oil Co.—Toledo, Ohio | Platform | 45,000 | CCR unit. |
| | Cat reform | 120,000 | $102.5 MM. Engr: M.W. Kellogg. 1991. |
| *Marcus Hooks, Pa. | Revamp | .... | FCC. Engr: Stone & Webster. 1991. |
| Champlin Refining & Chemicals Inc.— | | | |
| Corpus Christi, Tex. | Revamp | 56,000 | 62,000 total capacity. Gas Oil Hydrotreater. Completion: late 1991. |
| Citgo Petroleum Corp.— | | | |
| Lake Charles, La. | Revamp | 11,000 | 31,000 b/d total capacity. Hydrocracker. Contr: Lummus Crest. Late 1991. |
| Conoco Inc.— | | | |
| Lake Charles, La. | Expan | ..... | Specialty Coke. 4th Qtr. 1990. |
| Billings, Mt. | Coker | 12,500 | Delayed. Contr: Bechtel. 1993. |
| *Ponca City, Ok. | Lube | .... | Rebuild fire damage. |
| Chevron U.S.A. Inc.— | | | |
| El Segundo, Calif. | MTBE | 2,000 | In-house. Late 1990. |
| Pascagoula, Miss. | Revamp | .... | FCC Riser. Contr: Jacobs Engr. 1991. |
| El Paso, Tex. | Revamp | .... | Light ends recovery. Engr: Bechtel. 1991. |
| Port Arthur, Tex. | Revamp | .... | FCC Riser. Engr: Stone & Webster. 1992. |
| Citgo Petroleum Corp.— | | | |
| *Lake Charles, La. | Revamp | .... | FCC. Engr: Stone & Webster. 1990. |
| Coastal Chem. Inc.— | | | |
| *Cheyene, Wy. | MTBE | 4,000 | 2nd Qtr. 1992. |
| Diamond Shamrock R&M— | | | |
| Three Rivers, Tx. | Cat Reform | 10,000 | CCR. Engr/Contr: Howe-Baker. 1991. |
| El Paso Refining, L.P.— | | | |
| El Paso, Tx. | Crude | 27,500 | 55,000 b/d total capacity. 4th Qtr. 1991. |
| | Vacuum | 26,000 | 2nd Qtr. 1991. |
| | FCC | 14,200 | 4th Qtr. 1991. |
| | Alky | 4,500 | Sulfuric acid. 4th Qtr. 1991. |
| | Isom | 3,200 | $C_4$ feed. 1st Qtr. 1991. |
| Fina Oil & Chemical— | | | |
| Port Arthur, Tex. | Expan. | .... | $190 MM over all. Includes cat cracker, atmospheric crude tower, and saturate liquid recovery unit. FW and UOP. 1991 on all units. |
| Giant Refining Co.— | | | |
| Gallup, N.M. | Expan | 7,000 | Refinery. Design: Parsons. 1992. |
| Hill Petroleum Co.— | | | |
| Houston | Vacuum | 8,000 | 1990. |
| | Sol. Extr. | 8,000 | 1990. |
| Indiana Farm Bureau Cooperative Assoc. Inc.— | | | |
| Mt. Vernon, Ind. | CCR | 6,500 | UOP. May 1991. |
| | Hydrotreat | 4,000 | May 1991. |
| Lyondell Petrochemical— | | | |
| Channelview, Tx. | Alky | .... | 22 MBPD total cap. 1992. |
| Mapco—Memphis, Tn. | Crude | .... | 75,000 b/d total cap. Spring 1991. |
| Marathon— | | | |
| Texas City, Tex. | Revamp | .... | FCC. Engr: Stone & Webster. 1991. |
| Robinson, Ill. | Revamp | 14,000 | Alky unit. Contr: Fluor. 1990. |
| | MTBE | 1,700 | 1991. |
| Detroit, Mi. | Revamp | 7,000 | Kerosine Hydrotreater. Contr: Fluor. 1991. |
| | Revamp | .... | FCC. Engr: Stone & Webster. 1991. |
| | Platformer | .... | Contr: UOP/Fluor. 1992. |
| Mobil Oil Corp.— | | | |
| Paulsboro, N.J. | Lube | 3,800 | Blending. Pritchard. 1991. |

## REFINERIES

| Compeny and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Mandan, ND. | Cat Crack | .... | Regenerator cyclone replacement. Contr: Stone & Webster. |
| Yorktown, VA. | Cat Reform | .... | Ultraformer upgrade. |
| ARCO—Ferndale, Wash. | Expan. | 3,000 | Delayed Coker. Engr: Parsons. Contr: Bechtel. 1990. |
| Los Angeles | Revamp | .... | Resid Reprocessing. Engr: Jacobs. March 1991. |
| *Bellingham, Wa. | Upgrade | .... | diesel hydrotreater. |
| Ashland Petroleum— | | | |
| Catlettsburg, Ky. | Hydrotreater | 40,000 | Process: Foster Wheeler. Sept. 1993. |
| St. Paul, Minn. | Hydrotreater | 20,000 | Process: Foster Wheeler. Sept. 1993. |
| Canton, Ohio | Hydrotrearer | 20,000 | Process: Foster Wheeler. Sept. 1993. |
| BP Oil Co.—Toledo, Ohio | Platform | 45,000 | CCR unit. |
| | Cat reform | 120,000 | $102.5 MM. Engr: M.W. Kellogg. 1991. |
| *Marcus Hooks, Pa. | Revamp | .... | FCC. Engr: Stone & Webster. 1991. |
| Champlin Refining & Chemicals Inc.— | | | |
| Corpus Christi, Tex. | Revamp | 56,000 | 62,000 total capacity. Gas Oil Hydrotreater. Completion: late 1991. |
| Citgo Petroleum Corp.— | | | |
| Lake Charles, La. | Revamp | 11,000 | 31,000 b/d total capacity. Hydrocracker. Contr: Lummus Crest. Late 1991. |
| Conoco Inc.— | | | |
| Lake Charles, La. | Expan | ..... | Specialty Coke. 4th Qtr. 1990. |
| Billings, Mt. | Coker | 12,500 | Delayed. Contr: Bechtel. 1993. |
| *Ponca City, Ok. | Lube | .... | Rebuild fire damage. |
| Chevron U.S.A. Inc.— | | | |
| El Segundo, Calif. | MTBE | 2,000 | In-house. Late 1990. |
| Pascagoula, Miss. | Revamp | .... | FCC Riser. Contr: Jacobs Engr. 1991. |
| El Paso, Tex. | Revamp | .... | Light ends recovery. Engr: Bechtel. 1991. |
| Port Arthur, Tex. | Revamp | .... | FCC Riser. Engr: Stone & Webster. 1992. |
| Citgo Petroleum Corp.— | | | |
| *Lake Charles, La. | Revamp | .... | FCC. Engr: Stone & Webster. 1990. |
| Coastal Chem. Inc.— | | | |
| *Cheyene, Wy. | MTBE | 4,000 | 2nd Qtr. 1992. |
| Diamond Shamrock R&M— | | | |
| Three Rivers, Tx. | Cat Reform | 10,000 | CCR. Engr/Contr: Howe-Baker. 1991. |
| El Paso Refining, L.P.— | | | |
| El Paso, Tx. | Crude | 27,500 | 55,000 b/d total capacity. 4th Qtr. 1991. |
| | Vacuum | 26,000 | 2nd Qtr. 1991. |
| | FCC | 14,200 | 4th Qtr. 1991. |
| | Alky | 4,500 | Sulfuric acid. 4th Qtr. 1991. |
| | Isom | 3,200 | $C_4$ feed. 1st Qtr. 1991. |
| Fina Oil & Chemical— | | | |
| Port Arthur, Tex. | Expan. | .... | $190 MM over all. Includes cat cracker, atmospheric crude tower, and saturate liquid recovery unit. FW and UOP. 1991 on all units. |
| Giant Refining Co.— | | | |
| Gallup, N.M. | Expan | 7,000 | Refinery. Design: Parsons. 1992. |
| Hill Petroleum Co.— | | | |
| Houston | Vacuum | 8,000 | 1990. |
| | Sol. Extr. | 8,000 | 1990. |
| Indiana Farm Bureau Cooperative Assoc. Inc.— | | | |
| Mt. Vernon, Ind. | CCR | 6,500 | UOP. May 1991. |
| | Hydrotreat | 4,000 | May 1991. |
| Lyondell Petrochemical— | | | |
| Channelview, Tx. | Alky | .... | 22 MBPD total cap. 1992. |
| Mapco—Memphis, Tn. | Crude | .... | 75,000 b/d total cap. Spring 1991. |
| Marathon— | | | |
| Texas City, Tex. | Revamp | .... | FCC. Engr: Stone & Webster. 1991. |
| Robinson, Ill. | Revamp | 14,000 | Alky unit. Contr: Fluor. 1990. |
| | MTBE | 1,700 | 1991. |
| Detroit, Mi. | Revamp | 7,000 | Kerosine Hydrotreater. Contr: Fluor. 1991. |
| | Revamp | .... | FCC. Engr: Stone & Webster. 1991. |
| | Platformer | .... | Contr: UOP/Fluor. 1992. |
| Mobil Oil Corp.— | | | |
| Paulsboro, N.J. | Lube | 3,800 | Blending. Pritchard. 1991. |
| Beaumont, Tx. | Expan. | 40,000 | 325,000 total capacity. Crude. 3rd Qtr. 1992. |
| | Expan | 10,000 | Coker. 1992. |
| | Expan | 12,000 | Hydrocracker. 1992. |
| | CCR | 55,000 | 1992. |
| Murphy Oil USA Inc.— | | | |
| Meraux, La. | Expan. | 4,500 | Crude. $25 MM. Contr: Brown & Root. July 1990. |
| | Expan. | 5,000 | FCC. Contr: UOP & Hudson. July 1991. |
| National Cooperative Refinery Association.— | | | |
| McPherson, Kan. | CCR | 5,000 | Nov. 1991. |
| | Expan. | 5,000 | Pretreating cat reformer feed. Nov. 1991. |
| Pacific Refining Co.— | | | |
| Hercules, Calif. | Cat Crack | 22,000 | FCC unit. Engr/Design: Stone & Webster. 1991. |
| Phillips 66 Co.-- | | | |
| Borger, Tx. | Expan. | 7,500 | Star/MTBE. Design: Davy McKee. |
| Pasadena, Tx. | Expan. | 850 | Resins. Engr: Kellogg. 1990. |
| *Pride Refining— | | | |
| Ailene, Tx. | Cat Reform | 6,000 | Engr: Howe-Baker. 1991. |
| *Quaker State— | | | |
| Newell, WV. | Hydrotreat | 4,440 | Lube. April 1991. |
| Shell Oil Co.— | | | |
| Martinez, Calif. | Revamp | .... | Refinery. Engr. stage. Engr: Parsons. 1992. |
| Wilmington, Calif. | Revamp | .... | Refinery. Engr. stage. Engr: Parsons. 1992. |
| Norco, La. | Cat Crack | 90,000 | resid unit. Engr: Foster/Wheeler/Badger. Contr: KTI. Mid-1992. |
| Sohio Oil Co.— | | | |
| Deer Park, Tex. | Expan. | .... | FCC. Engr: Stone & Webster. 1990. |
| Star Enterprise— | | | |
| Port Arthur, Tex. | Coker | 40,000 | Delayed Contr: Brown & Root. 1993. |
| Delaware City, DE. | Expan | 3,000 | Alky. Contr: Pritchard/Stratco. 1990. |
| Sun R&M Co.— | | | |
| Marcus Hook, Pa. | Hydrotreat | 13,700 | Engr. Phase 1990. |
| Philadelphia, Pa. | Hydrocrack | 40,000 | FCC. Engr/Contr: Litwin. 1990. |
| Texaco USA.— | | | |
| Bakersfield, Calif. | Expan. | 5,000 | Hydrotreater. Engr: Bechtel. 1990. |
| *Total Petroleum— | | | |
| Ardmore, Ok. | Expan. | 8,500 | Kerosene caustic treater. Contr: Hower Baker. 1990. |

# REFINERIES

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Three B Oil Co.—Wickett, Tex. | Upgrade | 8,000 | Oil. $20 MM. |
| *Union Carbide—Lemont, Il. | Hydrogen | 4,800,000 SCFD | Engr: Howe-Baker. 1991. |
| Unocal—Arroyo Grande, Calif. | Revamp | .... | Plantwide. Engr: Braun. 1992. |
| Wilmington, Calif. | Revamp | .... | Hydrocracker. Contr: Fluor. 1990. |
| | Hydrotreat | .... | Study: Fluor. Process: Unocal. |
| | Reduction | .... | $NO_x$. Plantwide. Contr: Fluor/Wheeler. |
| U.S. Oil & Refining Co.—Tacoma, Wash. | Hydrocracking | 5,000 | VGO. type. 1992. |
| | Hydrogen | 9 MMcfd | Steam methane reforming. 1992. |
| Valero Refining Co.—Corpus Christi, Tex. | Cat Reform | 27,000 | CCR planned. 1st Qtr. 1992. |
| | Hydrocrack | 25,000 | Gasoil/distil. planned. 1st Qtr. 1992. |
| | Crude | 35,000 | distiller. 1991. |
| | Hydrotreat | 20,000 | Early 1992. |
| **ABU DHABI** | | | |
| Abu Dhabi National Oil—Ruwais | Expan. | 160,000 | Crude. 280,000 b/d total capacity. 1991-92. |
| | Expan. | 13,000 | Hydrocracking. 40,000 total capacity. |
| **ANGOLA** | | | |
| Cabinda Gulf Oil Co. Cabinda | Crude | 10,000 | Crude distilation unit. Engr: Howe-Baker. 1991. |
| **ALGERIA** | | | |
| Naftec—Skikda | Cat reform | 30,000 | JGC, C. Itoh. End 1992. |
| **ARGENTINA** | | | |
| Yacimientos Petroliferos Fiscales—La Plata | Cat Cracker | .... | Engr./Contr: Davy McKee. 1991. |
| **AUSTRALIA** | | | |
| Ampol Refineries Ltd.—Brisbane, Queensland | Cat reform | 5,000 | 19,000 total cap. Semi con-cat. Davy McKee. 1991. |
| | Crude | .... | distilation. Engr./Contr: Davy McKee. 1992. |
| | LPG | 894 | Recovery cryogenic. Linde. 1990. |
| Lytton, Queensland | Revamp | .... | FCC tail gas unit. Engr: Davy McKee. 1990. |
| Caltex Refining—Kurnell | FCC | .... | Revamp. Engr:Davy McKee. Contr: Stone & Webster. $10.5 MM. 1990. |
| | Revamp | .... | FCC unit. Engr./Contr: Davy McKee. 1992. |
| *Mobil Oil Corp.—Adelaide | Isom | 9,500 | $C_5/C_6$ |
| *Royal Dutch/Shell—Near Sydney | Reformer | 18,635 | Naphtha. Contr: Lummus Heat Transfer System. $60 Million. April 1991. |
| Shell Refining (Australia) Pty. Ltd.—Geelong | Cat crack | 34,000 | Long Residue Catalytic Cracking. Engr: Davy McKee. 1991. |
| Clyde | Cat reform | 19,800 | CCR. 2nd Qtr. 1991. |
| Petroleum Refineries (Australia) Pty Ltd.—Altona, Victoria | Revamp | .... | Bitumen unit. Engr/Contr: Davy McKee. 1990. |
| | Upgrade | .... | TCC alky unit. Engr/Contr: Davy McKee. 1990. |
| **BAHRAIN** | | | |
| Bahrain Petroleum Corp.—Awali | Cat Crack | .... | FCC. Engr: Stone & Webster. 1990. |
| **BELGIUM** | | | |
| Esso Belgium—Antwerp | Alky | 5,000 | Sulfuric acid. Contr: Foster Wheeler. Feb. 1991. |
| Fina Raffinaderij N.V.—Antwerpen | Platfomer | 45,000 | Naphtha. Lic: UOP. CCR tech. |
| | Hydrotreat | 47,000 | Naphtha. Contr: Foster. Jan. 1991. |
| **BOLIVIA** | | | |
| YPF—Cochabamba | FCC | 6,000 | New. |
| **BRAZIL** | | | |
| Petroleo Brasileiro S.A.—Araucária-Parana | Hydrotreat | 31,400 | Dist. Staff. 1992. |
| | Hydrogen | 28.0 MMscfd | Fuel gas. Staff. 1992. |
| Betim, MG | Coke | 20,400 | Staff/Promon. 1991. |
| Campinas | FCC | 40,000 | Lic: Kellogg. 1990. |
| Canoas, RGS | Crude | 113,200 | Planning. Staff. |
| | Hydrotreat | 25,100 | SR Dist. Staff. 1992. |
| | Hydrogen | 10.5 MMscfd | Steam Naphtha Reforming. Staff. 1992. |
| Capuava, SP | Distillation | 35,000 | Atmospheric. In-house. |
| Cubatão, SP | Hydrotreat | 31,500 | SR dist. Staff. 1991. |
| | Hydrogen | 22.8 MMscfd | Fuel gas. Staff. 1991 |
| Duque de Caxias | Hydrotreat | 31,500 | Dist. Staff. |
| Mataripe | Vac | 44,000 | Staff/A. Araujo. 1991. |
| Paulínia | Delay coke | 20,400 | Staff. 1992. |
| | FCC | 47,100 | 82,500 total cap. Under const. Kellogg/Promon/Staff. 1991. |
| | Hydrocrack | 28,400 | Resid upgrade. Staff. 1991. |
| | Hydrotreat | 62,900 | Dist. Staff. Planned. 1992. |
| | Hydrogen | 33.5 MMscfd | Fuel gas. Staff. 1992. Planned. |
| **BRUNEI** | | | |
| Brunei Shell Petroleum Co.—Seria | Cat reform | 5,400 | end 1991. |
| | Expan | .... | Platformer and feedstock treatment. Contr: Mann/Edeleanu. Aug. 1991. |
| *Kuala Belait | Reformer | .... | Contr: Edeleanu. 1991. |
| **CANADA** | | | |
| Consumer's Cooperative Refineries Ltd.—Regina | Alky | 6,000 | Alkylation unit ($H_2SO_4$) planned. 1991. |
| Dow Chemical—Fort Saskatchewan | Refinery | 70,000 | 120 million. natural gas liquids fractionation plant. |
| Husky Oil Operations—Lloydminster | Heavy oil | 54,000 | Hydrocrack (HRI) and delayed coker (FW). $1.3 billion. Sept. 1992. |
| | Expan. | 15,125 | Naphtha caustic wash treater. Engr: Howe-Baker. 1990. |
| *Hydrogenal—Becancour, Quebec | Hydrogen | 2.5 | MMscfd. Contr: KTI. 1991. |

# REFINERIES

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Petro-Canada—Edmonton | Revamp | 40,000 | FCC. Engr: Stone & Webster. 1990. |
| | Isom | 10,000 | Contr: Fluor Daniel. 1990. |
| Fort McMurray | Crude | 70,000 | $4 billion. Planned. |
| Suncor—Ontario | FCC | 19,000 | Replaces existing unit. MW Kellogg. |
| Turbo Resources Ltd.—Near Calgary | Upgrade | .... | 30,000 total capacity. |

## CHILE

| | | | |
|---|---|---|---|
| Petrox S.A. Refineria de Petroleo—Talcahuano | Cat reform | 500 | 4,500 total cap. Semi bim-cat. UOP. 1991. |
| Refineria de Petroleo—Concon—Concon | Hydrocrack | 8,500 | Dist. upgrade. Planned. Jan. 1993. |

## CHINA

| | | | |
|---|---|---|---|
| China Petrochemical Corp.—Huian co., Fujian province | Refinery | 350,000 | 1994. |
| Erlian, Inner Mongolia | Refinery | 20,000 | 1991. |
| Haikou Comprehensive Refinery Co.—Haikou, Hainan province | Refinery | 115,000 | 1992. |
| Sinopec—Guangzhou | Cat Crack | 20,000 | FCC unit. Engr: Stone & Webster. 1990. |
| Huang Pu | HDT-reform | 40,200 | Under const. CTIP. |
| | Demex | 16,000 | Vac resid. Design: UOP. |
| Nanjing | Cat Crack | 20,000 | FCC unit. Engr: Stone & Webster. 1990. |
| Zhenhai | Expan. | .... | FCC unit. 28,000 b/d total capacity. Engr: Stone & Webster. 1990. |

## CHINA, TAIWAN

| | | | |
|---|---|---|---|
| Chinese Petroleum Corp.—Kaohsiung | Cat reform | 25,000 | 95,000 total cap. Semi bim-cat. JGC. Mid 1992. |
| | Isom | 5,000 | Linde. Sept. 1993. |
| | TAME | 2,000 | Linde. Mid 1993. |
| Talinpu | Resid crack | 25,000 | FCC. Kellogg/CTCI. Mid-1991. |
| | Reformer | 30,000 | Mid-1992. No. 5 |
| | TAME | 2,000 | Linde. Mid-1993. |
| | Crude | 100,000 | Mid-1993. |
| | RDS #3 | 30,000 | Mid-1993 |
| | Isom | 5,000 | Linde. Mid-1993. |
| | Conversion | 14,000 | Olefin. Mid-1993. |
| Tao-yuan | JP-A1 HDS | 11,000 | Mid 1991. |
| | Isomer | 5,000 | Mid 1992. |
| | Hydrotreat | 25,000 | Mid 1994. |
| | Crude | 70,000 | Mid 1993. |
| | Cat reform | 20,000 | Mid 1994. |

## COLOMBIA

| | | | |
|---|---|---|---|
| Ecopetrol—Barrancabermeja | Crude | 30,000 | 180,000 total cap. TPL. 1990. |
| | Expan | 8,000 | FCC in the Engineering stage. Design: Air Product & Chemical Inc.. 1991. |
| | Expan | 4,700 | Solvent Dewaxing Lube (MEK) under construction. Engr: Badger. Tech: Texaco. 1990. |

## COSTA RICA

| | | | |
|---|---|---|---|
| Refinadora Costarricense de Petroleo—Puerto Limon | Crude | 20,[illegible] | Contr: Drgados. 1992. |
| | Cat Reform | 1,800 | Contr: Dragados. 1992. |
| | Hydrotreat | 2,000 | Naphtha. Contr: Dragados. 1992 |
| | Hydrotreat | 1,000 | Diesel. Contr: Dragados. 1992. |

## CZECHOSLOVAKIA

| | | | |
|---|---|---|---|
| Korama Kolin—Kolin | Lubes | 75,000 mt/y | Engr/Contr: KTI/Technoexport. 1991. |
| Slovnaft—Bratislava | Hydrocrack | 16,960 | Eng: Snamprogetti. 1990. |

## DENMARK

| | | | |
|---|---|---|---|
| A/S Dansk Shell—Fredericia | Expan | 5,864 | Naptha IsoSiv. Engr: Comprimo. 1990. |
| Norske Shell—Sola | Expan | .... | TIP Kero Merox |

## EGYPT

| | | | |
|---|---|---|---|
| Alexandria Petroleum.—(El-Mex) Alexandria | Lube | 100 mt/y | under study. |
| El-Nasr Petro. Co.—Suez | Crude | 51,600 | Distillation unit. End 1992. |

## FRANCE

| | | | |
|---|---|---|---|
| BP France—Lavera | Hydrotreater | 20,000 | Design: Wheeler. 1991. |
| | Isom | 11,000 | Design: Wheeler. Early 1991. |
| CRD Total—*Gonfreville | Isom | .... | Gasoline isomerisation unit. Turnkey contract: Heurtey industries. 1990. |
| *Raffinerie des Flanders | Cat reform | .... | Fractionating unit integrated with catalytic reformer. Contr: Heurtey Industries. 1991. |
| El France—Mormant | Hydroisom | 2,200 | Methane. |
| *Grandpuits | Hydrotreat | .... | Gasoline hydrotreatment unit. Contr: Heurtey Industries. 1991. |
| Esso SAF—Port Jerome | Expan | 700 | White oil. Contr: TPL. 1991. |
| Mobil Oil Francaise—Norte Dame de Gravenchon | Isom | 7,000 | $C_5/C_6$ |
| Shell—Berre L'Etang | Expan | 16,000 | Naphtha fractionation. Technip. 1990. |
| | Lube | 8,000 mt/y | 16,000 total capacity. |

## GERMANY, EAST

| | | | |
|---|---|---|---|
| Industrieanlagen Imports | Expan. | 24,000 | Vacuum distillation. Contr: Toyo Engineering Corp. Dec. 1991. |

## GERMANY, WEST

| | | | |
|---|---|---|---|
| Deutsche BP—Bavaria | Expan. | ... | Cat cracker. 1993-94. |
| Henkel—Dusseldorf | Refinery | 41,933 | Caustic $SO_2$. Contr: Linde. March 1991. |
| Huls AG—Marl | Hydrogen | 1.6 MMcf/hr | $21 MM. Uhde. |
| Oberrheinische Mineralolwerke GmbH—Karlsruhe | MTBE | 2,812 | Engr. Edeleanu GmbH. |

## GREECE

| | | | |
|---|---|---|---|
| Hellenic Aspropyrgus Refinery S.A.—Aspropyrgos | Hydroref | 9,700 | Gas oil deslf. 25,300 Total cap planned. |

## HUNGARY

| | | | |
|---|---|---|---|
| DKV Refinery Szazhalombatta—Danube Refinery | Expan | 12,050 | Naphtha hydrotreating unit and UOP platforming unit with CCR. under construction. Contr: Mannesmann. |

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Dunai Koolajipari Vall.– Szazhalombatta | Cat. Reform | 12,000 | Planning. Contr: Mannesmann. Aug. 1991. |

## INDIA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Cochin Refineries Ltd.– Kerala | Crude | 40,000 | 130,000 total capacity. |
| Eastern Refinery Ltd.– Chittagong | Visbreaking | 10,400 | Contr: Mannesman Anlagenton AG. 1991. |
| | Hydrocrack | 1,180 | Dist. upgrade. 1991. |
| | Hydrogen | 1.0 | MMcfd. Steam naphtha reforming. 1991. |
| Hindustan Petroleum Corp.–Bombay | Hydrotreat | 50,000 | Engr. stage. 1993. |
| | Lube | 150,000 | Engr. stage. 1993. |
| | Vacuum | .... | Engr. stage. Contr: KTI. 1991. |
| Mangalore | New ref | 120,000 | Proposed. $225 MM. Birlas 27%, Hindustan 26%. |
| Indian Oil Corp.– Assam | New ref | 600,000 | $665 MM. Proposed. 1994-95. |
| Barauni | Cat reform | 5,000 | 2nd Qtr. 1992. |
| Digboi | Cat reform | 1,400 | 2nd Qtr. 1992. |
| | Modernize | .... | $85 MM. |
| Gujarat | Vacuum | 49,700 | 96,700 total cap. M/S Engineers India. 1st Qtr. 1992. |
| | Visbreak | 11,350 | 30,250 total cap. 1st Qtr. 1992. |
| | Residual | 25,470 | Upgrading. Early 1992. M/S |
| Haldia | Revamp | .... | Lube oil plant. |
| Thanjavur | New Ref. | 30,000 | Chevron USA. |
| Madras Refineries Ltd.– Manali | Lubes | 301 | Additives plant. Joint venture with Chevron. |
| | Hydrocrack | 25,000 | Resid upgrade. Approved. Early 1992. |
| Tata-Indian Oil Refineries Ltd.–Karnal | Refinery | 120,493 | Planned. $1.1 billion. 1992. |

## INDONESIA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Pertamina Exor I– West Java | Refinery | 125,000 | Contr: Mitsui/JGC Corp./Foster Wheeler. 1993. |

## IRAN

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| National Iranian Oil Co.– Arak | Refinery | 150,000 | $1.8 billion. Contr: TPL. Dec. 1992. |
| Bandar Abbas | Refinery | 240,000 | Contr: Chiyoda Corp./Snamprogetti. 1990. |
| Esfahan | Lube | 3,618 | Eng. stage. FW Italiana. |
| Tehran | Lube | 3,700 | Furfural/Mek blending. Engr: Foster. End 1990. |

## IRAQ

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Oil Refineries Administration– *Basrah | Lube | .... | first phase. |
| | Wax | 17,000 | hydrofinishing. Contr: Snamprogetti. 1990. |
| *Daura | Expan. | 10,000 | Crude oil desalter. Engr: KTI/Technoexport. 1991. |
| | Lubes | 20,000 mt/y | Engr/Contr: Technoexport. 1991. |
| Musayab | Refinery | 150,000 | Contr: Chiyoda Corp./Mitsubishi Corp. $75 Million. |
| Tech Corp.– Messaiab | Refinery | 140,000 | Grass roots refinery. Contr: Bechtel. 1993. |
| Baghdad | Refinery | 40,000 | Contr: TPL. Dec. 1992. |

## ITALY

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Agip Raffinazione S.p.A.– Taranto | Isom | 3,920 | Contr: Snamprogetti. 1990. |
| Sannazzaro | Revamp | 30,000 | FCC. Contr: Foster Wheeler. June 1991. |
| API Raffineria di Ancona SpA–*Falconara | Expan. | 5,500 | thermal cracking heater. Engr: Lummus Crest. March 1991. |
| Esso Italiana–Augusta | Cat reform | 11,100 | 19,100 total cap. Semi bim-cat. 1991. |
| | Hydrotreat | 18,000 | Dist. 1992. |
| ICIP–Mantova | Hydrotreat | 3,000 | Dewax. Planned. 1990. |
| Mediterranea Raffineria Siciliana Petroli–Milazzo | Revamp | .... | Vacuum Distillation. Contr: Snamprogetti. 1990. |
| | Revamp | 10,000 | FCC. Contr: Snamprogetti. 1990. |
| Raffineria Siciliana Srl– Gela | FCC | 216 mt/h | Turboexpander of plant. Snamprogetti. 1991. |
| | Coking | 19,000 | Delayed. Contr: Snamprogetti. 1990. |
| *Saras SpA–Sarroch | Hydrocrack | 100,000 | Contr: Snamprogetti. 1991. |
| *Sarpom–Trecate | Expan. | 8,000 | FCC. 1992. |
| | Isom | 10,500 | $C_5$ and $C_6$ feed. 1st Qtr. 1991. |
| Soc. Ener. Montedison– Priolo | Hydrocrack | 5,700 | Dewax. Late 1990. |
| Stanic Spa–Livorno | Expan. | .... | 90,600 total cap. Atmospheric crude distillation. Snamprogetti. 1990. |

## JAMAICA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Petrojam Ltd.–Kingston | Vacuum | 12,350 | 14,250 total cap. 1992. |
| | FCC | 7,200 | 1992. |
| | Polymeriz | 418.5 | 1992. |

## JAPAN

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| *KOA Oil Co. Ltd.– Osaka | Alky | 3,000 | 3rd Qtr. 1991. |
| *Mitsubishi Oil Co. Ltd– Mizushima | Alky | 3,500 | 1st Qtr. 1991. |
| Sendai | Cat crack | 25,000 | FCC. Contr: M.W. Kellogg. |
| Nippon Mining Co. Ltd.– Mizushima | Cat Reform | 23,000 | CCR. Dec. 1990. |
| | Aromatics | 4,300 | BTX. Dec. 1990. |
| *Taiyo Oil Co. Ltd.– Kawasaki | Cat Reform | 15,000 | Chiyoda Corp. 3rd Qtr. 1991. |
| | Hydrotreat | 21,000 | Naphtha desulfurizing. Chiyoda Corp. 3rd Qtr. 1991. |
| | Arom | 8,200 | BTX. Chiyoda Corp. 3rd Qtr. 1991. |
| Yokohama | FCC | 30,000 | Resid. Engr: Stone & Webster. 1992. |

## JORDAN

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Jordan Petroleum Refinery– Zerqa | Upgrade | 9,200 | Vacuum. Basic design study. 1991. |
| | Convertion | 8,700 | Existing crude distl. unit to visbreaking. 1991. |
| | Upgrade | 1,700 | Hydrocrack. Basic design study. 1991. |

## KOREA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| *Hyundai Petrochemicals– Daesan | Hydrogen | 8,000,000 CF/D | Engr: Howe-Baker. 1990. |

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Kukdong Oil Co. Ltd's.—Daesan | Expan. | 100,000 | Dec. 1992. |
| | Vacuum | 2,000 | Sept. 1992. |
| | Cat Reform | 20,000 | Dec. 1992. |
| | Hydrotreat | 20,000 | Naphtha. Dec. 1992. |
| | Hydrotreat | 12,000 | Gas Oil. Dec. 1992. |
| | Lube | 2,000 | Sept. 1992. |
| | LPG | 4,000 | Dec. 1992. |
| *Ssangyong Oil Refining Co.—Onsan | Expan. | 150,000 | Crude oil desalter. Contr: Howe-Baker. 1990. |
| Yukong Ltd.—Ulsan | Vac | 45,000 | 89,000 total cap. |
| | Reform | 22,500 | 41,400 total cap. CCR. |
| | Hydrocrack | 27,000 | |
| | Hydroref | 27,000 | Resid desulf. |
| | Hydrotreat | 22,500 | 61,400 total cap. Feed pretreat. |
| | Hydrotreat | 9,000 | 19,500 total cap. SR dist. |
| | Aromatics | 880 | 1,680 total cap. Cyclohexane. |
| | Hydrogen | 50 MMcfd | Steam naph reform. |
| | LPG | 3,800 | Engr. stage. Engr: Parsons. 1991. |
| | LPG Sweet | 10,000 | Engr. stage. Engr: Parsons. 1991. |
| | Distiller | 40,000 | Product. Engr. stage. Engr: Parsons. 1991. |
| | Distiller | 150,000 | Crude. Engr. stage. Engr: Parsons. 1991. |
| | Reformer | 30,000 | Engr. stage. Engr: Parsons. 1991. |
| | Treater | 5,000 | Merox. Engr. stage. Engr: Parsons. 1991. |
| | Hydrotreater | 30,000 | Nahptha. Engr. stage. Engr: Parsons. 1991. |
| | Separator | 25,000 | Xylenes. Engr. stage. Engr: Parsons. 1991. |
| | Expan. | 60,000 | Crude oil desalter. Contr: Howe-Baker. 1990. |
| | Expan. | 115,000 | Crude oil desalter. Contr: Howe-Baker. 1990. |

## KUWAIT

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Kuwait National Petroleum—Mina Al-Ahmaid | Revamp | 10,000 | FCC. Lic: UOP. End 1992. |
| | Alky | 4,500 | Sulfuric acid. End 1992. |

## LIBYA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Sebha | Refinery | 20,000 | Contr: Compagnie Tecnic Internazionale Progetti SpA. Planned. |

## MALAYSIA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Esso Malaysia Berhad—Port Dickson | Cat reform | 7,300 | Under const. JGC. 1990. |
| Petroliam Nasional Bhd.—Malacca | Refinery | 200,000 | 2 refineries. Planned. |

## MEXICO

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| PEMEX—Salina Cruz | FCC | 40,000 | Engr: Kellogg. 1990. |
| Petroleos Mexicanos: | | | |
| Cadereyta, Nuevo Leon | Visbreak | 50,000 | Eng. stage. 1992 |
| Lazaro Cardenas, Mich. | New ref | 200,000 | Planned. |
| | Vacuum | 120,000 | |
| | Cat reform | 40,000 | |
| | Hydrotreat | 40,000 | Cat feed pretreat. |
| | Hydrotreat | 16,000 | Naphtha desulf. |
| | Hydrotreat | 50,000 | Distillates. |
| Salina Cruz | Visbreak | 50,000 | Eng. Stage. 1991. |
| | FCC | 40,000 | Eng. stage. Tech: M.W. Kellogg. Staff. 1991. |

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| | Cat reform | 30,000 | Cyclic bimcat. Naph. Eng. stage. Staff. 1990 |
| | Hydrotreat | 36,000 | Cat feed pretreat. Eng. stage. 1990. |
| | Hydroref | 50,000 | Mid dist. 2 units. Eng. stage. 1990. |
| Tula | Hydrotreat | 36,000 | Cat feed pretreat. Eng. stage. 1990. |
| | Hydroref | 50,000 | Mid dist. 2 units. Eng. stage. 1990. |
| | Cat reform | 30,000 | Semi bimcat. Naph. Eng. stage. 1990. |

## THE NETHERLANDS

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Shell—Pernis | Hydrocrack | .... | Engr. stage. 1992. |
| Total Raffinaderij Nederland N.V.—Vlissingen | Expan | .... | Kero-Merox. System debottlenecking. Platformer heater revamp. Contr: Badger. 1991. |

## NIGERIA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Nigerian National Petroleum Corp.—Kaduna | Merox | 6,000 | $14.3 MM. |
| Port Harcourt | Rehab. | .... | 60,000 total cap. Rehabilitation following fire damage. 2nd Qtr. 1991. |

## NORWAY

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| A/S Norske Shell—Sola | Expan | 4,000 | isom. End 1990. |
| | Expan | 8,000 | Kero Merox unit. End 1990. |

## PAKISTAN

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Attock Refinery Ltd.—Rawalpindi | Crude | 18,400 | 48,900 total cap. Howe-Baker. 1991. |
| | Vacuum | 8,500 | 9,500 total cap. Howe-Baker. 1991. |
| | Visbreak | 5,000 | Howe-Baker. 1990. |
| National Refinery Ltd.—Karachi | Expan. | 3,610 | Bimetallic catalyst catalytic reforming. |

## PAPUA NEW GUINEA

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| *Chevron Niugini Pty. Ltd. | Crude | 1,500 | Distillation unit. Engr: Howe-Baker. 1991. |

## PERU

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Petroleos del Peru—Iquitos | Vacuum | 1,620 | 1990. |
| | Cat reform | 1,620 | 1990. |
| La Pampilla | Vacuum | 33,000 | UOP. $280 MM. 1993. |
| | Visbreak | 33,000 | UOP. 1993. |
| | FCC | 15,000 | UOP. 1993. |
| Talara | Crude | 13,000 | 75,000 total cap. 1992. |
| | Vacuum | 22,200 | 43,800 total cap. 1992. |
| | FCC | 6,400 | 23,000 total cap. 1992. |

## PORTUGAL

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| *Petrogal—Porto | Expan. | 30% | Unifiner/Platformer in the engineering stage. Contr: Wheeler. 1991. |

## POLAND

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| Mazovian Refinery and Petrochemical Works—Plock | CCR | 18,264 | Platforming. UOP. 1992. |
| | Expan. | 18,264 | Pretreating cat reformer feeds. |
| | Expan. | 20,151 | Dist. |
| Mazowieckie Zaklady Rafineryjne i Petrochemiczne | Platformer | 1,406 | CCR tech. UOP process. |

# REFINERIES

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| **PUERTO RICO** | | | |
| Caribbean Petroleum Corp.—Bayamon | Modernize | 42,000 | $25 Million. |
| Puerto Rico Sun Oil Co.—Yabucoa | Hydroref | 17,000 | Heavy gas oil. 1992. |
| | Solvent | 22,000 | Extraction. 1992. |
| **QATAR** | | | |
| National Oil Distribution.—Umm Said | Isom | 5,500 | Penex-Molex. Eng. stage. 1992. |
| | Revamp | .... | Process Condensate. 50,000 total capacity. Engr: Kellogg. 1991. |
| **SAUDI ARABIA** | | | |
| Al Sultan Trading & Const. and Haji Hashi Muhammad Hashi Co.—Near Mogadishu | Refinery | 200,000 | prefeasibility study. |
| Petromin-Mobil—Yanbu | Lubes | 4,109 | $160 MM. Plans revived. |
| Petromin-Shell—Al Jubail | Merox | 11,600 | UOP Equitec Services will build. |
| Petromin-Petrola—Rabigh | Crude | 325,000 | Atmospheric crude distillation. Contr: Snamprogetti. 1990. |
| **SINGAPORE** | | | |
| Esso | Conversion | 50,000 | Visbreaking, Naphtha Hydrofiner and Hydrogen recovery unit. End 1990. |
| Mobil Oil Singapore—Jurong | Hydrocrack | 22,000 | $80 MM both units. |
| | Crude | 223,000 | |
| | Vacuum | 86,000 | |
| | Thermal | 53,000 | |
| | Hydrorefining | 11,000 | |
| **SOMALIA** | | | |
| Mogadishu | Refinery | 190,000 | $500 MM. Late 1990. |
| **SPAIN** | | | |
| Century Oils Ltd.—Urduliz, Bilbao | Lube plant | 301 | $9 MM. Late 1990. |
| Cepsa—San Roque | Cat reform | 35,000 | $65 MM. Lic: UOP. CCR Platforming process. Late 1991. |
| ERCROS SA—Huelva | Cracker | 12,500 | Fluid catalytic cracker. Dec. 1991. (formely ERCROS SA.) |
| Indian Additives Ltd.—Manali | Lube plant | 301 | Joint venture with Madras Refineries Ltd. and Chevron Chemical Co. |
| Petronor—Bilbao | Modernize | .... | $90 MM. |
| Repsol Petroleo—Corunna | Asphalt | 100,000 | mt/y. Early 1991. |
| La Coruna | Expan. | 15,000 | Dec. 1990. |
| | Asphalt | 6,000 | Contr: Tecnicas Reunidas. Dec. 1990. |
| Puertollano | Alky | 3,650 | Contr. Tecnicas. 1991. |
| Somorrostro, Bilbao | Alky | 5,500 | Mid-1992. |
| Tarragona | Cat Reform | .... | Late 1992. |
| Petronor—Somorrostro | Alky | 5,300 | Contr: Tecnicas. 1992. |
| **SWEDEN** | | | |
| Skandinaviska Raff. Scanraff—Lysekil | FCC | .... | Eng: Foster Wheeler. 1991. |
| | Isom | 11,900 | $C_5$ and $C_6$ feed. Dec. 1990. |
| **TANZANIA** | | | |
| Tanzania Petroleum Development Corp.—Dar-Es-Salaam | Refinery | 30,000 | Bitumen. Snamprogetti. 1990. |
| | Vacuum | .... | Snamprogetti. 1990. |
| **THAILAND** | | | |
| Bangchak Petroleum—Bangkok | Modernize | 20,000 | Dist. unit. 40,000 total capacity. $80 MM. Contr: Chiyoda. |
| | | 14,000 | Resid cracker. |
| Esso Standard Thailand—Cholburi | Crude | 37,000 | 100,000 total cap. $200 MM. Planned. |
| Royal Dutch/Shell Group—'Mab Ta Phud, Rayong province | Refinery | 145,000 | 1994. |
| Thai Oil Co. Ltd.—Chonburi | Crude dist. | 100,000 | Unlincensed. 1992. |
| | Hydrotreat | 29,000 | Naphtha. UOP. 1992. |
| | Platformer | 22,000 | CCR. UOP. 1992. |
| | Merox | 18,000 | Kerosine. UOP. 1992. |
| | LPG unit | .... | Unlicensed. 1992. |
| Sriracha | Expan. | 93,000 | Distillation capacity. Contr: Foster Wheeler. End 1992. |
| | Kero Merox | 17,200 | End 1992. |
| | Hydrotreater | 30,900 | Naphtha Minus. End 1992. |
| | Cat reform | 23,800 | CCR. End 1992. |
| **TURKEY** | | | |
| Turkish Petroleum Refining—Aliaga-Izmir | Vacuum | 42,000 | 1993. |
| | Visbreak | 19,000 | Lic: Lummus Crest BV. 1993. |
| | Hydrocrack | 16,500 | Dist. upgrade. Lic: UOP. Contr: Snamprogetti. 1992. |
| | Hydrogen | 34.0 MMscfd | Steam naphtha reform. 1993. |
| Korfez-Izmit | Isom | 5,000 | Tech: UOP. I990. |
| Kirikkale, Ankara | Hydrocrack | 14,500 | Lic: UOP. JGC. 1992. |
| | Hydrogen | 23.0 MMscfd | Contr: JGC. Lic: UOP. 1992. |
| **UNITED KINGDOM** | | | |
| Eastham Refinery Ltd.—Ellesmere Port | Crude | 18,000 | Expan. |
| | Vacuum | 15,750 | |
| | SR asphalt | 12,000 | |
| Esso Petroleum Co. Ltd.—Fawley | Expan | .... | Residfiner. Contr: Davy McKee. 1990. |
| | Expan | .... | Hydrotreater, FCC & Dewaxer. Contr: Bechtel. 1990. |
| Gulf Oil Refining Ltd.—Milford Haven, Dyfed | Expan. | 5,000 | Crude. 1990. |
| | Expan. | 2,000 | Bimetallic catalyst catalytic reforming. 1990. |
| Mobil Oil—Coryton | Crude | 152,000 | |
| | FCC | 52,000 | |
| Phillips-Imperial Petroleum Ltd.—Port Clarence | Dewax | 6,800 | Heavy distillate catalytic dewaxer unit. $19.9 MM. Late 1990. |
| Teeside | Upgrade | .... | Engineering stage. Contr: Davy McKee. 1991. |
| Shell UK Ltd.—Shell Haven | Expan | .... | Naphtha minus complex. Contr: Davy McKee. 1992. |
| Texaco Ltd.—Pembroke, Wales | Hydrotreat | 20,000 | Mid-dist. Contr: Foster Wheeler. Early 1991. |

## REFINERIES

| Company and location | Project | Capacity (b/d) | Remarks & completion |
|---|---|---|---|
| **U.S.S.R.** | | | |
| Omsk | Fraction | 51,107 | Gaso feed. Technip. |
| | Hydrodesulf | 21,925 | Eng: Litwin. |
| Ufa | Gaso feed | 51,107 | Technip over all. |
| | HDA | 21,925 | Eng: Litwin. |
| **VENEZUELA** | | | |
| Corpoven—El Palitc | Cat reform | 2,500 | Expan-revamp. BTX units. Lic: UOP: Contr: Kellogg and Inelectra. $117 MM. 1990. |
| | Expan | 9,000 | Cat cracking. FCC unit. Total cap. 54,000. Lic./Engr: UOP, $36MM, 1991. |
| | MTBE/TAME | .... | Lic/Engr: Intevep. Engr. stage. $11MM. 1992. |
| Puerto La Cruz | Expan | 900 | Alky unit. Lic: Phillips. Engr: C.F. Braun/Inelectra/Phillips. Total capacity: 4,500. 1991. |
| | Expan | 120,000 | Distillation units. Total cap. 230,000. $110MM. 1993. |
| Lagoven—Amuay | MTBE/TAME | ... | $25MM. Eng. stage. Lic./Engr: Intevep. 1992. |
| | Expan. | 23,000 | Flexicracker. Total cap. 108,000. Lic: Exxon. Engr: Tecnofluor. $65MM. 1991. |
| Maraven—Cardon | MTBE/TAME | .... | Lic. & Engr: Intevep. Engr. stage. $22MM. 1991 |
| | Expan. | 6,500 | Trearer jet fuel. Lic: Merichem. Engr: Jantesa. $4.6MM. 1991. |
| | Expan. | 14,000 | Catalytic cracking unit. FCC. Total cap. 75,000. Lic: Shell. Engr: Shell/Maraven. $15MM. 1992. |
| **VIET NAM** | | | |
| Government | Refinery | 60,000 | Engineers India Ltd. Feasibility study. |
| **YUGOSLAVIA** | | | |
| Rafinerija Nafte Rijeka—Rijeka | Visbreaking | 10,400 | Contr: Technip. 1991. |
| Rafin. Nafte Pancevo—Pancevo | Cat reform | 17,800 | Semi bimcat. UOP. 1995. |
| | Hydrotreat | 25,500 | 34,300 total cap. UOP. 1995. |
| | Arom-BT | 215 | 2,815 total cap. UOP. 1990. |
| **ZAMBIA** | | | |
| Indeni Petroleum Refinery Co. Ltd.—Bwanamkubwa | Vac | 500 | 2,900 total cap. UOP. 1990. |
| | Hydrotreat | 4,800 | Dist. upgrade. UOP |

# Petrochemicals—WORLDWIDE CONSTRUCTION

*Designates projects listed for the first time in the Journal.

### UNITED STATES

**AIR PRODUCTS. Deer Park, Tx.** Polyvinyl alcohol plant under construction. Engr/Design/Contr: Bechtel. Completion: 1991.

**AMOCO CHEMICAL. Texas City, Tx.** Paraxylene debottleneck under construction. Completion: 1991.

**Chocolate Bayou, Alvin, Tx.** *300 million lb/y polypropylene plant in the engineering stage. Contr: John Brown. Completion: 1992.

**ARCO CHEMICAL. Channelview, Tex.** 500 MM lb/yr Propylene oxide and 1.125 billion lb/yr styrene monomer expansion under construction. $400 MM. Contr: Badger/ S&B Eng: HB Zachry. Completion: 1992.

*Polyols expansion in the engineering stage. Contr: John Brown. Completion: 1991.

**BETHLEHEM STEEL. Sparrow Point, Md.** 4,900 mt/y modified claus unit in the engineering stage. Contr: Still Otto GmbH.

**BORG-WARNER CHEMICALS. Geismar, La.** (with Union Texas Petroleum and BASF) Phase II: 30,000 lb/y ethylene expansion. Feed: Ethane, propane. 1,500 lb/y propylene. Planned. Completion: Early 1991.

**CHAMPLIN REFINING AND CHEMICALS INC. Corpus Christi, Tex.** 2,000 Btx revamp to increase capacity to 7,000 b/d. Completion: 3rd Qtr. 1991.

2,700 b/d toluene disproportionation unit (converting existing reformer). Completion: 3rd Qtr. 1991.

**CHEVRON CHEMICAL. Orange, Tx.** 280 MMlb/y expansion of high density polyethylene plant in the engineering stage. Contr: John Brown E&C. Engr. Completion: Early 1991.

***CHEVRON USA. Beaumont, Tx.** hd polyethylene in the engineering stage. Engr: John Brown. Completion: 1991.

***COMBUSTION ENGINEERING INC. Niles, Oh.** WSA-SNO$_x$ plant under construction. Design/Engr: Snamprogetti. Completion: 1993.

**COSMAR INC. Freeport, Tex.** 230,000 t/y aromatics plant in the engineering stage. Engr: Krupps Koppers. Completion: 1992

**Gulf Coast.** 1,000 MM lb/d styrene monomer plant. Completion: 1993.

***DOW CHEMICAL. Freeport.** 260,000 t/y benzene plant. Contr: Krupp Kopper.

***DUPONT. Orange, Tx.** ethylene expansion in the engineering stage. Engr: Lummus Crest. Completion: 1991.

**EXXON CHEMICAL CO. Baytown, Tx.** 150 MMlb/y paraxylene and 22 MMgal/y benzene units. Completion: Mid-1991.

***EASTMAN. Longview, Tx.** 100,000 t/y polypropylene plant. Completion: 1991.

***EPSILON. Marcus Hook, Pa.** 120,000 t/y polypropylene plant. Completion: 1991.

**FORMOSA PLASTICS CORP. U.S.A. Point Comfort, Tex.** 680,000 t/y ethylene plant, derivative units, and related facilities under construction. $3 billion. Engr: Kellogg. Completion: 1991.

*300,000 t/y ethylene glycol plant in the engineering stage. Lic: Scientific Design. Engr: H-R International. Completion: 1991.

*130,000 mt/y polypropylene plant. Completion: 1991.

**Pasadena, Tex.** 71,200 t/y phenol expansion and 42,700 mt/y acetone expansion. Feed: Cumeme. $36 MM. Planned.

**HUNTSMAN CHEMICAL CORP. Belpre, Ohio.** 32,000 t/y polystyrene expansion. Contr: Lummus Crest.

***Woodbury, NJ.** 150,000 t/y polypropylene plant. Completion: 1992.

**MELAMINE CHEMICALS. Donaldsonville, La.** 30 MM lb melamine plant. Feed: Urea.

**MOBIL CHEMICAL. Joliet, Ill.** 120 MM lb/y high impact polystyrene production line which will boost capacity of resins to 485 MM lb/y. Completion: 1991.

***Pasadena, Tx.** olefins plant expansion under construction. Contr: Fish. Completion: 1991.

**NL CHEMICALS. Lake Charles, La.** 80,000 t/y titanium dioxide under construction. Contr: Zachry. Completion: May 1991.

**OCCIDENTAL CHEMICAL.** 1 billion lb/y olefins unit at either Corpus Christi, Chocolate Bayou, or Lake Charles. Preliminary engineering studies under way.

**Corpus Christi, Tx.** 450,000 t/y vinyl chloride monomer unit under construction.$200 MM. Eng: Becon. Contr: Bechtel. Completion: 1991.

***OXYCHEM. Chocolate Bayou, Tx.** butadiene plant in the engineering stage. Engr: John Brown. Completion: 1991.

**OXYMAR. Corpus Christi, Tx.** 1,500,000 t/y ethylene dichloride plant in the engineeering stage at an undisclosed location. Engr: Toyo Corp. Completion: 1992.

**PETRO OIL & GAS INC. Sheridan, Wyo.** (joint venture with Perkins Power Inc.) 50 t/d polyurethane plant. $50 MM.

# PETROCHEMICAL

**PHILLIPS 66. *Pasadena, Tx.** 1.8 billion lbs/y polyethylene rebuild. Design: Kellogg/S&B Engr. Contr: Brown & Root/H.B. Zachry. Completion: 3rd Qtr. 1992.

***Old Ocean, Tx.** 1.5 billion lbs/y ethylene expansion at sweeny plant. Design/Contr: Brown & Root. Completion: Early 1991.

*681,000 lb/y ethylene and propylene plant. Contr: Brown & Root. Completion: 1st Qtr. 1991.

**POLYSAR POLYMERS. Orange, Tx.** Expansion of EPDM Rubber plant in the engineering stage. Engr: Bechtel. Completion: 1991.

**QUANTUM—USI DIVISION. Morris, Ill.** 66,000 t/y polypropylene expansion under construction. Feed: Propylene. Completion: 1991.

80,000 t/y ethylene expansion. Feed: Ethane, propane, butane. Eng: Lummus. Contr: Braun. Completion: 1991.

**RHONE-POULENC. Baton Rouge, La.** 4,500 t/y Vanillin, 5,000 t/y Ethyl Vanillin under construction. Contr: Zachry. Completion: Aug. 1991.

**SHELL CHEMICAL. Gulf Coast.** 450 million lb/y each of ethylene oxide and ethylene glycol. Completion: 1993.

**SOUTH HAMPTON CO. Silsbee, Tex.** 1,000 b/d solvent fractionation expansion in the engineering stage. Engr: Frantz

**SUN OIL CO. Philadelphia, Pa.** $126 MM Environmental work. Additions: alky unit, propane-propylene recovery unit and sulfur recovery unit, also upgrading the fluid catalytic cracker.

**TENNECO INC. LaPorte, TX.** 12,500 t/d metyl tertiary butyl ether plant. Contr: Kellogg. Completion: Early 1992.

**TENNESSEE EASTMAN. Kingsport, Tenn.** Chemicals from coal expansion in the engineering stage. Engr: Bechtel. Completion: 1991.

Acetic acid expansion in the engineering stage. Contr: Bechtel. Completion: 1991.

**TEXACO CHEMICAL CO. Port Neches, Tex.** Modernation of butadiene unit which will increase capacity by 50 MM lb/y. Completion: Spring 1991.

Propylene Oxide, MTBE plant in the engineering stage. Engr: Bechtel. Completion: 1991.

**TEXAS EASTMAN CO. Longview, Tex.** 110,000 t/y polypropylene plant planned. Feed: Propylene. Completion: 1991.

125,000 t/y polyethylene plant planned. Feed: Ethylene. Completion: 1992.

25,000 t/y amorphous polyolefins plant planned. Feed: Propylene. Completion: 1991.

**UNICO INC. Commerce City, Co.** 25 million gal/y methanol plant. Completion: 1st Qtr. 1991.

**UNION CARBIDE CHEMICALS & PLASTICS CO. INC. TAFT, LA.** 410 MM lb/y expansion of ethylene oxide plant. $200 MM.

**UNOCAL. West Sacramento, Ca.** Expansion of nitrogen fertilizers complex. Engr: Fluor Daniels. Completion: 1992.

**WESTLAKE STYRENE CORP. Gulf Coast.** 160,000 t/y ethylbenzene/styrene plant in the engineering stage. Contr: Badger. Completion: 1992.

**WESTLAKE POLYMERS. Lake Charles, La.** 1 billion lb/y ethylene plant under construction. Feed: NGL. Engr: Kellogg. Contr: KCI. $250 MM. Completion: Spring 1991.

## ALGERIA

$170 billion petrochemical complex (joint venture with India). 450,000 mt/y ethylene. Proposed.

**ENTERPRISE NATIONALE DE LA PETROCHIMIE. Skikda.** 50,000 mt/y linear alkylbenzene intermediates. UOP process. $80 MM.

## ARGENTINA

***ELECTRODOR. Bahia Blanca, Buenos Aires.** 41,500 mt/y polyvinyl chloride plant under construction. Engr: Davy McKee. Completion: 1991.

**PASA PETROQUIMICA ARGENTINA. Campana.** 40,000 mt/y urea expansion planned. Feed: Natural gas. Completion: 1992.

**Neuquen.** 150,000 mt/y urea plant planned. Feed: Natural gas. Completion: 1992.

**Puerto Gral. San Martin, Santa Fe.** 60,000 mt/y benzene expansion planned. Feed: Xylene, toluene, naphtha. Completion: 1991.

120,000 mt/y styrene expansion planned. Feed: Naphtha. Completion: 1991.

120,000 mt/y propylene expansion planned. Feed: Propane. Completion: 1994.

100,000 ACN plant planned. Feed: Propylene. Completion: 1994.

***Rosario.** ethylbenzene expansion in the engineering stage. Completion: 1993.

*styrene monomer expansion in the engineering stage. Completion: 1993.

**San Lorenzo, Sante Fe province.** ethylene expansion in the engineering stage. Completion: 1993.

**PETOQUIMICA BAHIA BLANCA SAIC. Bahia Blanca, Buenos Aires Province.** 200,000 mt/y ethylene plant. $241 Million. Turnkey contract: Lummus Crest, Italy's CTIP, Techint of Italy and Argentina. Project calls for olefins unit, pyrolysis gas unit, $C^4$ hydrogenation unit and other facilities. End 1992.

**PETROQUÍMICA GENERAL MOSCONI. Ensenada.** Polyethylene terephthalate plant (12,000 mt/y fibre-grade; 5,000 mt/y bottle-grade) in the engineering stage. Contr: Krupp Koppers. Completion: 1992.

*45,000 mt/y dimethl terephthalate plant in the engineering stage. Contr: Krup Koppers. Completion: 1992.

***PEREZ/HIMONT. Neuquen.** 100,000 mt/y polypropylene plant. Completion: 1992.

**POLITENO. Camaçari.** 130,000 mt/y polyethylene expansion. Feed: Ethylene. Lic: DuPont. Completion: 1991.

## AUSTRALIA

**ALTONA PETROCHEMICAL CO. Altona.** Ethylene expansion in the engineering stage. 310,000 mt/y total capacity. Lic: Stone & Webster. Completion: 1992.

**SHELL CHEMICAL (AUSTRALIA) PTY. LTD. Clyde, NSW.** 80,000 mt/y polypropylene plant to replace existing plant. Feed: Refinery gas. Completion: Mid-1991.

## BAHRAIN

**BAHRAIN GOVERNMENT.** 100,000 mt/y propylene and polypropylene complex. $200 MM. Feasibility study: Bechtel. Completion: 1991.

## BELGIUM

**AMOCO CHEMICAL CO. Geel.** 250,000 mt/y terephthalic acid expansion under construction. Contr: TPL. Completion: June 1991.

**Belgium.** 945 mt/d nitric acid plant under construction. Completion: 1991.

**BAYER ANTWERPEN NV. Antwerp.** 23,000 mt/y polycarbonate plant under construction. Feed: Bisphenol A. Contr: Fluor Daniel.

24,000 mt/y polycarbonate plant. Feed: Bisphenol A. Contr: Fluor Daniel. Planned.

**DEN NORSKE STATS OLJESEKSKAP AS and HIMONT NORTH SEA PETROCHEMICAL INC. Antwerp.** 400,000 mt/y splitter for the propylene plant. Feed: Gas liquids. $404 MM. Tech: Air Products & Chemicals. Contr: Kellogg. Completion: 1991.

**ETHYL SA. Feluy.** 36,000 mt/y polyalphaolefin plant.

200,000 mt/y linear alpha olefins plant. $100 MM. Completion: 2nd half 1991.

**EXXON CHEMICAL. Meerhout.** 450,000 mt/y ethylene unit in engineering stage. Feed: Naphtha. Lic: MW Kellogg. Contr: MW Kellogg/FW Italiana. Completion: 1991.

***FINANESTE N.V. Antwerp.** 450,000 mt/y ethylene plant under construction. Engr/Contr: Kellogg/FWI. Completion: 1991.

***HIMONT/STATOIL. Antwerp.** 180,000 mt/y polypropylene plant. Completion: 1991.

**MONSANTO. Antwerp.** Polyvinyl butyral resin expansion under construction. Contr: Badger.

**NORTH SEA PETROCHEMICAL. Antwerp.** 250,000 mt/y Propylene plant in the engineering stage. Design: Air Product. Completion: 1991.

***PETROCHIM NV. Feluy.** 126,000 mt/y hd polyethylene unit. Contr: Technip. Completion: 1991.

**SOLVAY GROUP. Antwerp.** 100,000 mt/y high density polyethylene plant. Completion: Late 1991.

*120,000 mt/y polypropylene plant. Completion: Late 1991.

## BRAZIL

**CAPUAVA CARBONOS INDUSTRIAIS SA. Maua, SP.** 27,000 mt/y carbon black expansion planned. Feed: Ethylene tar. $25 MM. Completion: 1992.

**Triunfo, RS.** 27,000 mt/y carbon black unit. Feed: Ethylene tar. $30 MM. Planned. Completion: 1991.

**COPENE. Camaçari.** 450,000 mt/y ethylene, 290,000 mt/y propylene, 86,000 mt/y butadiene, 420,000 mt/y pyrolysis gasoline, 200,000 mt/y aromatics (BTX) units under construction. Feed: Gas oil, naphtha. $548 MM. Completion: 1991.

86,000 mt/y butadiene plant under construction. Feed: Crude, $C^4$. Completion: 1991.

25,000 mt/y butene 1 plant under construction. Feed: Raffinate 2. $15 MM. Completion: 1991.

**COPERBO. Cabo.** 35,000 mt/y polyisoprene plant in engineering stage. Feed: Isoprene.

8,000 thermoplastic elastomer plant planned. Feed: Butadiene, styrene.

***ESTIRENO DO NORDESTE. Camacari, BA.** 175 mt/y ethylbenzene revamp in the engineering stage. Engr: Lummus Crest. Completion: 1992.

***NITROFERTIL. Camacari.** 160,000 mt/d nitric acid expansion in the design stage.

360,000 mt/d urea expansion in the design stage.

Retrofitting existing ammonia plant (200 mt/d) to produce oxo gas and hydrogen. In the design stage.

***Laranjeiras.** 500,000 mt/d urea expansion in the design stage.

**NITROCARBONO SA. Camacari.** 15,000 mt/y caprolactam and 30,000 mt/y ammonium sulfate expansion planned. Feed: Cyclohexanone, ammonia, hydrogen.

15,900 mt/y cyclohexanone and 4,200 mt/y sodium sulfate expansion planned. Feed: Cyclohexane.

**OXIQUÍMICA. Triunfo.** 25,000 mt/y acrylic acid, 30,000 mt/y esters planned. Feed: Propylene. $55 MM. Contr: Mitsubishi. Completion: 1991.

***PETROFLEX. Rio de Janiero.** Styrene revamp in the engineering stage. Completion: 1992.

**PETROQUÍMICA UNIÃO. Santo André.** 440,000 mt/y ethylene, 245,000 mt/y propylene, 75,000 mt/y butadiene, 386,000 mt/y aromatics units (all total capacities) under way. Feed: Naphtha. Completion: 1991.

**POLIALDEN PETROQUIMICA. Camaçari.** 100,000 mt/y polypropylene under evaluation. Feed: Propylene.

***POLIBRASIL. Itaguai.** 100,000 mt/y polypropylene plant. Completion: 1991/92.

**POLIOLEFINAS SA. Camacari, Bahia.** 130,000 mt/y linear polyethylene plant. Union Carbide process. Completion: 1991.

***Sao Paolo.** 100,000 mt/y polypropylene plant. Completion: 1992.

**POLITENO. Camacari.** 130,000 mt/y low linear density polyethylene plant under construction. Contr: Lummus/Setal. Completion: 1991.

**PRONOR PETROQUIMICA SA. Camacari.** 30,000 t/y toluene diisocyanate expansion under way. Feed: Toluene, chlorine, natural gas, nitric acid. Completion: 1991.

52,000 dimethyl terephthalate expansion planned. Feed: Paraxylene, methanol. Completion: 1991.

8,000 diphenyl methane diisocyanate expansion planned. Feed: Benzene, chlorine, formaldehyde. Completion: 1992.

**PROSINT PRODUTOS SINTÉTICOS SA. Rio de Janeiro.** 79,200 mt/y methanol expansion planned. Feed: Natural gas. $35 MM (U.S.) Completion: Early 1993.

***SOLVAY. Sto. Andre, SP.** Vinyl chloride monomer, polyvinyl chloride revamp in the engineering stage. Completion: 1992.

## BULGARIA

**CHIMINVEST. Bourgas.** 50,000 mt/y linear low density polyethylene plant. $50 MM. Sclairtech process. Lic: DuPont Canada. Contr: Lummus Crest. Engr: Combustion Engineering Inc.

**Devnja.** 150,000 mt/y vinylchloride monomer, 120,000 mt/y ethylene dichloride units in engineering stage. Contr: TEC. Completion: 1990-91.

***NEFTOCHIM. Bourgas.** 14,000 mt/y acrylic fibre plant under construction. Completion: 1992.

## CANADA

**ALBERTA GAS ETHYLENE CO. LTD. Joffre, Alberta.** 680,000 mt/y ethylene, 20,000 mt/y propylene, 28,000 mt/y butadiene, 27,000 mt/y aromatics plant planned. $350 MM. Feed: Ethane. Completion: 1992.

**ALBERTA NATURAL GAS. Scotford.** 2,000 mt/d methanol, 11,600 b/d MTBE. Feed: Natural gas, butane. $600 MM.

**BORDEN CANADA. Edmonton, Alta.** 35,000 mt/y formaldehyde expansion under way. Feed: Methanol.

**Laval, Que.** 35,000 mt/y formaldehyde expansion under way. Feed: Methanol.

**Laval, Que.** 25,000 mt/y formaldehyde expansion under way. Feed: Methanol.

**Vancouver, B.C.** 25,000 mt/y formaldehyde expansion under way. Feed: Methanol.

**West Hill, Ont.** 12,000 mt/y formaldehyde expansion under way. Feed: Methanol.

**CARGILL LTD. Bell Plaine, Sask.** 1,500 mt/d anhydrous ammonia, 2,000 mt/y urea units. $350 MM. Completion: Spring 1992.

**NESTE OY. Edmonton, Alta.** (joint venture with Petro-Canada) 500,000 mt/y methyl tertiary butyl ether plant. $210 million. Contr: Fluor Daniel Inc. Completion: 1991.

**NOVA CORP. Joffre, Alta.** 250,000 mt/y polyethylene pelletizing unit. $30 million. Contr: Fluor Daniel Inc. Completion: 2nd Qtr. 1991.

**PETROMONT INC. Montreal, Quebec.** 200,000 mt/y HD Polyethylene plant expansion in the engineering stage. $75 MM. Contr: Bechtel. Completion: July 1991.

***Varennes, Quebec.** 40,000 mt/y ethylene revamp under construction. Engr: Stone & Webster. Completion: 1991.

**SAFERCO. Belle Plaine.** 500,000 mt/y synthesis gas/ammonia expansion under construction. Engr: Uhde. Completion: 1992.

**SHELL CANADA. Corunna, Ont.** 40,000 mt/y styrene expansion planned. Feed: Benzene, ethylene. Completion: 1991.

**UNION CARBIDE. Prentiss.** 360,000 mt/y ethylene glycol plant planned. Feed: Ethylene. Completion: Late 1992.

**WESTCOAST ENERGY INC. Taylor, B.C.** Ethane-based petrochemical plant under consideration. Seeking bids.

## CHILE

**MINCO.** 560,000 mt/y ammonia-urea plant. $350 MM. Planned.

## CHINA

50,000 mt/y ethylene oxide and ethylene glycol units. Royal Dutch Shell process. $53.5 MM. Contr: Technip. Completion: 1991.

72,000 mt/y linear alkylbenzene, 54,000 mt/y linear olefins units. UOP tech.

120,000 mt/y ethylene unit. Lummus Crest tech.

80,000 mt/y lld polyethylene unit. Sclairtech process. Lic/Engr/Contr: Lummus Canada.

**Jinxi, Liaoning Province.** 1,000 mt/d ammonia plant in engineering stage. Tech: Braun. Contr: Technip. Completion: 1991.

**Erlian, Inner Mongolia.** 300,000 mt/y ammonia, 520,000 mt/y urea. Planned.

150 t/d ammonia expansion under way. $10 MM. Contr: Humphreys & Glasgow.

**Panjing, Liaoning Province.** 130,000 mt/y ethylene plant. Feed: Ethane, propane, butane from Liao He field. Design/Engr/Tech: Lummus Crest. Contr: TEC/C. Itoh/TPL. Completion: Sept. 1991.

125,000 mt/y lld polyethylene, 40,000 mt/y polypropylene, 10,000 mt/y butene 1 units. Lic: BP on polyethylene, Mitsui PC on polyprop, IFP on butene. Contr: Technipetrol. Completion: Sept. 1992.

**Shantou Special Economic Zone.** 250,000 mt/y of ethylene, 480,000 mt/y of synthetic resin, 150,000 mt/y of solid caustic soda, and 180,000 mt/y of other chemicals. $800 MM complex proposed by Thai Co. Ltd.

**Shengli.** 80,000 mt/y SBR unit under construction. Contr: Mitsubishi Heavy.

**Xinjiang Uygur Autonomous Region.** $600 MM petrochemical complex that includes a 140,000 mt/y ethylene plant.

**CHIA TAI CO. LTD. Shantou Special Economic Zone, Guangdong Province.** $800 MM petrochemical complex (250,000 mt/y ethylene, 480,000 t/y synthetic resin, and 180,000 t/y organic chemicals and other products).

**CHINA INTERNATIONAL PETROCHEMICAL CO. Shanghai petrochemical complex.** 80,000 mt/y polyethylene plant. Tech: Mitsubishi. Contractor: Snamprogetti.

**CHINA NATIONAL CHEMICAL CONSTRUCTION CORP. Hebei, Henan, Shanxi and Beijing Provinces.** 4 urea plants, 400 mt/d each, under construction. Contr: Snamprogetti. Completion: 1991.

**Taizhou, Jiaugsu.** Secondary Butanol-Alcohol and Methyl Ethyl Ketone plant in the engineering stage. Process design: Edeleanu Gmbh. Completion: 1991.

***CHINA NATIONAL MACHINERY IMPORT AND EXPORT CORP. Baoji.** 400 mt/d urea plant under construction. Design: Snamprogetti. Completion: 1992

**CHINA NATIONAL TECHNICAL IMPORT CORP. Fuling, Sichuan Province.** 1,750 mt/y Urea plant under construction Design: Snamprogetti. Completion: 1993.

***Fushun.** 72,000 mt/y linear alkybenzene plant under construction. Contr: Tecnicas. Completion: 1991.

*50,000 mt/y ethylene oxide and 50,000 mt/y ethylene glycol unit. Contr: Technip. Completion: 1992.

**Hejiang, Sichuan Province.** 1,000 mt/d ammonia plant in engineering stage. Tech: Braun. Contr: Tecnimont. Completion: 1991.

1,765 mt/d urea plant under construction. Contr: Snamprogetti. Completion: 1991.

**Jinan.** 75,000 mt/y pure terephthalic acid plant in engineering stage. Contr: MES. Completion: 1991.

**Jinxi.** 1,760 mt/d urea plant under construction. Design: Snamprogetti. Completion: 1993.

**Luoyang.** 50,000 mt/y polypropylene plant in the engineering stage. Completion: Jan. 1992.

**Sichuan.** 15,000 mt/y alcohols plant in engineering stage. Eng/des: Uhde. Lic: Henkel. Completion: 1991.

**Puyang.** 40,000 mt/y polypropylene plant under construction. Contr: Tecnimont. Completion: 1992.

***Weifang, Shandong.** 6,000 mt/y polyethylene plant under construction. Engr: Uhde GmbH.

**CHINA NORTH INDUSTRIES CORP. Lanzhou.** 44 MM lb/y toluene diisocyanate plant. Contr: BASF AS.

**JILIN CHEMICAL IND. Jilin.** 27,200 mt/y acrylic acid unit in engineering stage. Contr: JGC. Completion: 1992.

30,000 mt/y acrylic ester unit in engineering stage. Contr: JGC. Completion: 1992.

*40,000 mt/y ethylene oxide plant in the engineering stage. Lic: Scientific Design.

**NANJING ORIENTAL CHEMICALS IND. CORP. Nanjing.** 50,000 mt/y caprolactam plant in engineering stage. Contr: Didier/Voest Alpine. Process: Stamicarbon. Completion: 1992.

**QINGDAO COTTON MILL NO. 2. Quingdao Shandong Province.** 7,000 mt/y polyamide 6 polymerisation plant in the engineering stage. Contr: Zimmer. Completion: 1992.

**SHANGHAI PETROCHEMICAL COMPLEX. Shanghai.** 70,000 mt/y polypropylene unit under construction. Eng/Design/Contr: Tecnimont. Completion: 1991.

**SHANTOU OCEAN AUDIO & VIDEO GENERAL CORP. Shantou, Guangdong Province.** 50,000 mt/y polystyrene plant. $21 MM. Contr: Fluor Daniel China Services Inc. Completion: Late 1991.

**XIANGTAN FINE CHEMICAL CO. Hunan Province.** 1,500 mt/y skid-mounted ethylene amine plant. Prebuild and ship by MACC, Calgary and Fort Saskatchewan Eng. Serv., Canada. $3 MM.

**YIZHENG CORP. Yizheng.** (Joint venture with Amoco Chemical). Polypropylene and purified terephthalic acid plants planned.

**ZHENIANG CHEMICAL FACTORY. Zheijiang Province.** (joint venture with Dow Chemical). 20,000 mt/y propylene oxide, 20,000 mt/y polyether polyol, 5,000 mt/y propylene glycol. $50 MM. Contr: Dow Chemical. Completion: 1993.

**ZHONG YUAN PETROCHEMICAL UNITED CORP. Puyang, Henan Province.** 140,000 mt/y polyethylene plant in engineering stage. Tech: DuPont Canada. Contr: CTIP/CNTIC. $180 MM. Completion: 1992.

140,000 mt/y ethylene plant in engineering stage. Tech: Lummus Crest. Contr: CTIP/CNTIC. Completion: 1992.

## CHINA, HONG KONG

**CABOT PLASTICS. Hong Kong.** 10,000 mt/y expansion of polymer compounding plant in the engineering stage. Contr: Simon-carves. Completion: 1991.

***HONG KONG PETROCHEMICALS CO. Hong Kong.** 75,000 mt/y polystyrene plant in the engineering stage. Engr: Tecnimont. Completion: 1992.

## CHINA, TAIWAN

**CHINESE PETROLEUM CORP. Kaohsiung.** 400,000 mt/y ethylene, 230,000 mt/y propylene, 67,500 mt/y butadiene, 14,000 b/sd aromatics units under construction. Feed: Naphtha and gas oil. Contr: Kellogg. Completion: Mid-1992.

**Lin Yuan.** 200,000 t/y No. 2 xylene separation, 12,000 b/d BTX and 75,000 b/d Naphtha-pretreat plant under construstion. Contr: JGC/CTCI. Completion: 1992.

**CHINA PETROCHEMICAL DEVELOPMENT CORP. Kaohsiung.** 2,000 mt/y naphthalene unit under construction. Feed: Fuel oil.

*Olefins conversion plant in the engineering stage. Engr: Foster Wheeler. Completion: 1991.

**Ta-Sheh.** 66,000 mt/y acrylonitrile expansion planned. Feed: Propylene. 80,000 mt/y acetic acid expansion planned. Feed: Carbon monoxide.

**Toufen.** 65,000 mt/y caprolactam expansion planned. Feed: Cyclohexane.

**CHINA PETRO-CHEMICAL INTERNATIONAL CO.** 15,000 mt/y Polystyrene (SAN) plant. Contr: Toyo Engineering Corp.

**CHIUNGLONG PETROCHEMICAL CO. LTD. Kaohsiung.** 22,000 mt/y polypropylene glycol unit under construction.

**CIBA GEIGY TAIWAN LTD. Kaohsiung.** 6,000 mt/y Phonolic anti-oxidant plant. Engr/Design: CTCI. Completion: 1991

***CNTIE CORP. Fushun.** 6,000 mt/y modacrylic fibre plant in the engineering stage. Completion: 1992.

**FORMOSA PLASTICS CORPORATION. Taipei.** 24,000 mt/y epichlorohydrin plant in the engineering stage. Contr: Comprimo. Completion: 1991.

**GRAND PACIFIC PETROCHEMICAL CORP. Kaohsiung.** 120,000 mt/y styrene monomer plant. Feed: Ethylene, benzene. Planned. Completion: 1991.

***HUALON. Ta Yuan.** 29,750 mt/y polyamide 6 polymerisation in the engineering stage. Completion: 1991.

**HO TUNG CHEMICAL CORP. Jen-Wu, Kaohsiung.** 40,000 mt/y n-paraffins plant under construction. Feed: Kerosine. Completion: 1991.

**ICI.** New PTA plant and offsites. Contr: John Brown. Completion: 1992

**IMPERIAL CHEMICAL INDUSTRIES PLC. Taiwan.** 350,000 mt/y terephthalic acid plant. $250 MM. Contr: John Brown. Completion: Early 1990's.

**NAN YA PLASTICS CORP. Naju.** 150,000 mt/y 2-Ethyl Hexanol, 20,000 Butanols in the engineering -stage. Engr: Davy McKee. $100MM.

**ORIENTAL UNION CHEMICAL CORP. Kaoshiung.** Ethyiene glycol plant. Feed: Ethylene. Planned.

**TAIWAN FERTILIZER CO. Miaoli.** 10,000 mt/y melamine plant under construction. Feed: Urea. Completion: June 1991.

**UNION PETROCHEMICAL CORP. Lin Yuan.** 32,300 mt/y phthalic anhydride plant and 3,000 fumaric acid plant under construction. Contr: Davy McKee. Completion: 1991.

## COLOMBIA

**AMONIACO DEL CARIBE. Cartagena.** 50 mt/d ammonia expansion under construction. Feed: Natural gas.

**CARBOQUIMICA. Bogota.** 20,000 mt/y plasticizers expansion. Planned. Feed: Phthalic anhydride, oxoalcohols. Staff will build.

**DOW QUIMICA DE COLOMBIA. Cartagena.** 40,000 mt/y polystyrene plant. Feed: Styrene. $16MM. Completion: Late 1991.

## CZECHOSLOVAKIA

**TECHNOEXPORT-PRAHA. Lovosice.** 1,200 mt/d Calcium, Ammonia, Nitrate plant in the engineering phase. $43 MM. Completion: 1991.

## EGYPT

**ABU QIR FERTILIZERS & CHEMICAL INDUSTRIES. Abu Qir.** 330,000 mt/y ammonia plant under construction. Contr: Uhde. Lic: Uhde. Completion: 1991.

***EGYPTIAN PETRO. CO. El-Amerya-Alex.** 80,000 mt/y ld & hd polyethylene plant under study.

## FRANCE

**ATOCHEM. Gonfreville.** 110,000 mt/y polyethylene unit. Proposed.

***Lavera.** 4,000 mt/y polybutadiene plant in the engineering stage. Completion: July 1991.

**BP CHEMICAL. Lavera.** Revamp and extend Polybutene capacity.

**CRD TOTAL. Flandres, Dunkirk.** Addition of a propane/propylene unit under construction. Contr: Heurtey Industries.

**EXXON CHEMICAL LTD. Le Havre.** 140.000 mt/y polypropylene plant. Proposed.

**EXXON CHEMICAL LTD. AND SHELL CHIMIE. Notre Dame de Gravenchon.** 220,000 mt/y linear low density polyethylene plant in the engineering stage. $158 MM. Contr: Foster Wheeler. Completion: Late 1991.

140,000 mt/y polypropylene plant in the engineering stage. Contr: Foster Wheeler. Completion: Late 1991.

**NAPTHACHIMIE SA. Lavera.** 150,000 mt/y ethylene plant upgrade, debottlenecking cracker 4. Turnkey/Contr: Lummus Crest. 1992.

**NORSOLOR. Chaling.** Polystyrene plant in engineering stage. Contr: Foster Wheeler Francaise. Completion: 1991.

***OXOCHEMIE SA. Lavera.** 170,000 mt/y n-butyraldehyde in the engineering stage. Contr: Davy McKee. Completion: 1991.

**SHELL CHIMIE. Berre L'Etang.** Thermo-plastic rubber plant. Contr: Technip. 1991.

*130,000 mt/y polypropylene plant. Completion: 1991.

***SOLVAY & CIE. Antwerp.** 100,000 mt/y hd polyethylene and 80,000 mt/y polypropylene in the engineering stage. Completion: 1991.

## GERMANY (EAST)

**Schkopau.** 25,000 mt/y hd polyethylene plant under construction. Unipol process. Feed: Ethylene. Contr: Linde AG.

## GERMANY, WEST

**BASF. Ludwigshafen.** 140,000 mt/y acrylic acid expansion in engineering stage. Contr: Lurgi.

***Wesseling.** 60,000 mt/y polypropylene plant. Completion: 1991.

**COLUMBIAN CARBON. Hamburg.** Carbon black expansion planned. Feed: Oil.

***DEUTSCHE SHELL. Godorf.** Aromatics revamp in the engineering stage. Completion: 1992.

***DMP MINERALOL. Burghausen.** 310 mt/y ethylene revamp in the engineering stage. Completion: 1992.

**HOECHST. Knapsnack.** 120,000 mt/y polypropylene plant. Completion: 1991.

**HULS AG. Gelsenkirchen-Scholven.** 75,000 mt/y polypropylene plant planned. Unipol process. Completion: Early 1991.

**Lulsdorf.** 60,000-70,000 mt/y dimethyl terephthalate revamp. Completion: 1992.

100,000 mt/y pure terephthalate acid plant. Completion: 1992.

**Marls.** 75,000 mt/y polypropylene expansion under construction. Feed: Propylene. Completion: Early 1991.

Acetylene plant in the engineering stage. Contr: Linde. Completion: 1991.

*260,000 mt/y oxychlornation plant in the engineering stage. Design: Lurgi GbmH. Completion: 1992.

*140,000 mt/y viynl chloride plant in the engineering stage. Design: Lurgi GbmH/ completion: 1992.

**RHEINISCHE OLEFINWERKE. Wesseling.** 120,000 mt/y expansion of Ethylene plant in the engineering stage. (two cracking furnaces) Completion: Early 1991.

90,000 mt/y expansion olefin plant in the engineering stage. Tech: Linde Completion: 1991.

***ROHM GmbH. Worms.** 20,000 mt/y dispersed polymers expansion in the design stage. Lic: Rohm.

**RUHR OEL. Gelsenkirchen.** 70,000 mt/y cumene expansion. Feed: Benzene, propylene.

440,000 mt/y ethylene, 260,000 mt/y propylene expansion planned. Feed: Naphtha. Contr: Linde.

*100,000 mt/y benzene plant in the engineering stage. Feed: pyrolysis gasoline. Lic/Contr: Lurgi GmgH. Completion: 1992.

*100,000 mt/y bezene plant in the engineering stage. Lic: Veba Oel Tech. Contr: Lurgi GmbH. Completio: 1992.

***Munchsmunster.** 80,000 mt/y ethylene and 60,000 propylene expansion under construction. Contr: Lummus. Completion: 1991.

***Scholven.** 143,000 mt/y aromatics in the engineering stage. Design: Lurgi GbmH. Completion: 1992.

***SHELL. Wesseling.** 120,000 mt/y polypropylene plant. Completion: 1991.

**UNION RHEINISCHE BRAUNKOHLEN KRAFTSTOFF. Wesseling.** Planned expansion of the following: 40,000 mt/y ethylene, 23,000 mt/y propylene, 12,000 mt/y C4-cut, 26,000 mt/y pyrolysis gasoline, 4,000 mt/y fuel oils. Feed: Naphtha. Contr: Lummus Crest/Santa Fe Braun. Completion: 1990-91.

**VEBA OEL AG. Gelsenkirchen.** 440,000 mt/y olefin plant in the engineering stage. Contr: Linde. Completion: 1992.

## HUNGARY

***CHEMOLOMPLEX. Leninvaros.** 8,000 mt/y isobutene under construction. Design: Snamprogetti. Completion: 1992.

**DUNAMONT CO. LTD. Szazhalombatta.** 65,000 mt/y polystyrene plant under construction. Feed: Styrene. Contr: Tecnimont/ Danube Refinery. Completion: 1991.

20,000 mt/y polystyrene plant under construction. Feed: Styrene. Contr: Tecnimont/Danube Refinery. Completion: 1991.

## INDIA

**ANDHRA PETROCHEMICAL LTD. Visakhapatnam, Andhra Pradesh.** 30,000 mt/y 2-ethyl hexanol butanols (LP oxo process) under construction. Contr: Davy McKee. Completion: 1991.

**ASSAM INDUSTRIAL DEVELOPMENT CORP. Maron-Lakwa.** Planned facility for 7,500 mt/y methanol, 12,000 mt/y formaldehyde, 6,000 mt/y PVC. Engineering on methanol: Humphreys & Glasgow.

**CHAMBAL FERTILIZERS & CHEMICALS LTD. Gadepan, Kota district.** 1,3500 mt/d amonia plant under construction. Contr: Snamprogetti. Completion: 1991.

1,125 mt/d each, 2 urea plants under construction. Contr: Snamprogetti. Completion: 1991.

**CONSOLIDATED FIBRES & CHEMICAL LTD. Haldia.** 12,000 mt/y Acrylc fibre plant under construction. $57 million. Contr: Davy Powergas. Completion: 1991.

**DEEPAK FERTILIZERS & CHEMICALS CORP. LTD. Taloja, Maharashtra.** 300 mt/d methanol plant under construction. $70 MM. Contr: Davy Powergas India. Completion: 1991.

**FERTILIZERS AND CHEMICALS TRAVACORE LTD. Ambalamedu.** 397,000 mt/y ammonia expansion (replacement of old plants with expansion in capacity.) Feed: Naphtha. Contr: Fact Engineering. Pending government approval.

***FINOLEX. Ratnagiri.** 80,000 mt/y polyvinyl chloride plant in the engineering stage. Desgin: Uhde GmbH.

*20,000 mt/y polyvinyl chloride plant in the engineering stage. Design: Uhde GmbH.

*100,000 mt/y vinyl chloride monomer plant in the engineering stage. Design: Uhde Gmbh.

**GAS AUTHORITY OF INDIA LTD. Auraiya, Uttar Pradesh.** Undisclosed volume of olefins and polyolefins. $1.665 billion. Planned.

***Vijaipur.** 100,000 mt/y polypropylene plant in the engineering stage. Engr: Tecnimont. Completion: 1992.

**GNFC. India.** 620 mt/d nitric acid, 100 mt/d high conc. nitric acid, 475 mt/d nitric phosphate, 475 mt/d calc. amm. nitrate. New plant under construction. Contr: Uhde Gmbh. Completion: 1990/91.

**GUJARAT GODREJ INNOVATIVE CHEMICAL LTD. Bharuch, Gujarat.** 30,000 mt/y Alpha Olefins plant under construction. Contr: Davy Powergas. Completion: 1991.

**GUJARAT NARMADA VALLEY FERTILIZERS CO. LTD. Narmadanagar, Bharach.** 50,000 mt/y acetic acid unit under construction. Feed: Methanol, carbon monoxide. $40 MM. Contr: BP/MES. Completion: Dec. 1991.

**GUJARAT STATE FERTILIZERS CO. LTD. Fertilizernagar.** 50,000 mt/y caprolactam unit under construction. Feed: Benzene. $307 MM. BASF tech. Contr: Uhde. Completion: July 1991.

1,350 mt/d ammonia expansion planned. Feed: Naphtha, natural gas. $230 MM. Completion: Early 1991.

10,000 mt/y melamine expansion planned. Feed: Urea. $31 MM.

**HERDILLIA CHEMICALS LTD. Thane.** 3,500 mt/y alkyl phenols unit under way. Feed: Phenol olefins. Contr: Power Gas India.

10,000 mt/y EDPM rubber. Feed: Ethylene, propylene. Planned.

2,000 mt/y diphenyl oxide. 1,500 mt/y isopropyl phenols, 1,000 mt/y plasticizers units. Planned. Feed: Phenol, propylene, phosphorous, oxychloride.

5,000 mt/y Polybutenes plant under construction. Contr: Davy Powergas. Completion: 1991.

***HINDUSTAN PETROLEUM CORP. Visakapatnam.** 23,000 mt/y propylene expansion in the engineering stage. Completion: 1991.

*45,000 mt/y N-paraffin expansion planned. Completion: 1994.

**INDIAN ADDITIVES LTD. Madras.** 15,000 mt/y lube oil additives plant. Completion: End 1991. (joint venture of Chevron Chemical Co. and Madras Refineries Ltd.)

**INDIAN OIL CORP. Baroda.** Steamreformer shift PSA in the engineering stage. Contr: Linde. Completion: 1991.

**INDIAN PETROCHEMICAL CORP. LTD. Gujarat.** petrochemical complex. $1.525 billion.

**Nagothane.** Ethylene instrunemtation in the engineering stage. Engr: Stone & Webster. Completion: 1992.

***KESAN PETROPRODUCTS LTD. Lote Parsurahn.** 5,000 mt/y bisphenol A in the engineering stage. Contr: Davy McKee. Completion: 1992.

**McDOWELL & CO. LTD. (Polymers Division). Visakhapatnam.**

5,000 mt/y ABS plant under construction. Feed: Acrylonitrile, butadiene, styrene. Completion: 1991.

66,000 mt/y styrene expansion planned. Feed: Ethylene, benzene. Completion: 1992.

20,000 mt/y polystyrene expansion planned. Feed: Styrene. Completion: 1992.

**MURABLACK INDIA LTD. Tarapun.** 9,000 mt/y carbon black plant in the engineering stage. Contr: Davy McKee. Completion: 1991.

**NAGARJUNA FERTILIZERS & CHEMICALS LTD.**

**Kakinada, Andhra Pradesh.** 1,500 mt/y urea, 900 mt/d ammonia units under construction. Feed: Naphtha. Contr: Snamprogetti/PDIL Completion: May 1991.

**NATIONAL PETROCHEMICAL CORP. Koyali, Gujarat.** 100,000 mt/y ethylene, 60,000 mt/y propylene, 9,000 mt/y butadiene, and 12,000 mt/y mixed butadienes.

**POLYPROPYLENE INDIA LTD. Mathura District.** 30,000 mt/y polypropylene. Lic: Solvay tech. Completion: Mid-1990. (29% Kanoria Group, 11% each Solvay, Pradeshiya Industrial Investment Corp., 49% public).

**RASHTRIYA ISPAT NIGAM. Visakhapatnam.** 33,000 mt/y aromatics plant in the engineering stage. Contr: Krupp Koppers. Completion: 1991.

**RELIANCE INDUSTRIES LTD. Hazira, Gujarat.** Six petrochemical plants costing a total of $685 million.

**SYNTHETICS & CHEMICALS LTD. Bareilly.** 48,750 mt/y styrene expansion planned. Feed: Alcohol, benzene.

47,000 mt/y SBR plant planned. Feed: Styrene, butadiene.

**TATA CHEMICALS LTD. Babrala, Uttar Pradesh.** 1,350 mt/d ammonia plant under construction. Contr: Snamprogetti. Completion: 1992.

2 urea units, 1,125 mt/d each under construction: Contr: Snamprogetti. Completion: 1992.

**THIRUMALAI CHEMICALS LTD. Ranipet (Tamil Nadu).** 4,000 mt/y polyester resins plant under construction. $1.5 MM. Contr: Staff.

10,000 mt/y maleic anhydride plant in the engineering stage. Feed: Benzene, butane. $22 MM. Contr: Alusuisse Italia/Davy Powergas. Completion: 1991.

## INDONESIA

**Bunyu, East Kalimantan.** 300,000 mt/y MTBE plant. Completion: 1993.

60,000 mt/y acetic acid plant. Completion: 1993.

**Dumai, Sumatra.** 75,000 mt/y normal paraffins plant. Completion; 1992.

**Musi, South Sumatra.** 10,000 mt/y MEK plant. Completion: 1992.

**BP CHEMICALS. West Java.** (joint venture with Indonesian government) 400,000 mt/y polyethylene plant. $200 MM. Completion: 1991.

**INDO RAMA SYNTHETICS.** 50,000 mt/y Polyester plant under construction. $60 million. Contr: Davy Powergas India. Completion: 1991.

**OLEFIN CENTER SHELL GROUP. Cilacap, Central Java.** 50,000 mt/y ethylene, 50,000 mt/y propylene, 225,000 mt/y polyethylene, 125,000 mt/y polypropylene, 100,000 mt/y ethylene glycol, 120,000 mt/y LPG, 45,000 mt/y fuel gas, 240,000 mt/y fuel oil, 170,000 mt/y $C_5$-Py gas, and 120,000 mt/y $C_9$-Py gas units. Completion: 1993.

**PERTAMINA. Arun, Aceh, North Sumatra.** 321,000 mt/y benzene, 19,600 mt/y toluene, 217,000 mt/y xylene mix, 39,700 mt/y orthoxylene, 180,000 mt/y CHX units planned. Feed: Condensate. Contr: Kellogg-Thyssen-Humpuss. $1,275 MM (U.S.). Completion: 1992-93.

**Cilacap, Java.** 375,000 mt/y ethylene, 225,000 mt/y propylene, 300,000 mt/y polyethylene, 180,000 mt/y polypropylene, 100,000 mt/y MEG units planned. Feed: Naphtha, raffinate, residue. $1,500 MM (US). Completion: 1993.

270,000 mt/y paraxylene, 120,000 mt/y benzene, 11,220 mt/y aromatics, 23,000 LPG, 93,720 mt/y raffinate units under construction. Feed: Naphtha. $416 MM (US). Contr: JGC Consortium. Completion: 1990-1991.

**Pare-Pare, South Sulawesi.** 660,000 mt/y methanol plant. Feed: Natural gas. $282 MM (US). Completion: 1992.

**Plaju, South Sumatra.** 30,000 mt/y polypropylene expansion. Feed: Propylene. $40 MM (US). Completion: 1992.

**PERTAMINA, BRITISH PETROLEUM, CHEVRON (Gulf Corp.). PT ARSETO. Cilegon, West Java.** 300,000 mt/y polyethylene plant. Completion: 1991.

***PETROKIMIA NUSANTARA INTERINDO. Merak, West Java.** (joint venture of B.P. Co., Mitsui Petro. Industires Ltd., and Sumitomo Chemical Co.) 400,000 mt/y polyethylene plant. Completion: Late 1992.

**PT ARUN AROMATIK INDONESIA. Arun, Sumatra.** 321,200 mt/y benzene, 39,700 mt/y orthoxylene, 180,000 mt/y cyclo hexane, 19,600 mt/y toluene, 217,200 mt/y mixed xylene, 254,000 mt/y LPG, 225,800 mt/y raffinate, 776,000 mt/y kerosene, 719,000 mt/y EPCC bottoms, and 676,000 mt/y depropanizer bottoms units. Completion: 1992.

**PT ASEAN POLYMERS. Cilegon, West Java.** 100,000 mt/y polypropylene plant. Completion: 1991.

**PT BRANTA MULIA.** Nylon 66 plant in the engineering stage. Design & Engr: Bechtel. Completion: 1991.

***PT GRAHA SWAKARSA PRIMA. West Java.** 120,000 mt/y ethylbenze to styrene monomer unit.

**PT INDORAMA SYNTHETICS. Purwakarta.** 52,500 mt/y polyester polycondensation in the engineering stage. Contr: Zimmer. Completion: 1991.

**PT PUPUK SRINIDAJA. Pelembang, South Sumatra.** 1,350 mt/d ammonia plant and 1,725 mt/d urea plant under construction. Lic: Toyo Engineering Corp. Completion: Late 1992.

**PT TRI POLYTA INDONESIA. Cilegon, West Java.** 160,000 mt/y polypropylene plant. Contr: Toyo Engineering Corp. Completion: 1993.

***PT YASON PERSADA. Tangerang.** 22,750 mt/y polyamide 6 polyerisation plant in the engineering stage. Contr: Zimmer. Completion: 1992

***SUMITOMO. Java.** 100,000 mt/y polypropylene plant. Completion: 1991.

***STYRENE MONOMER INDONESIA. Merak.** 100 kt/y styrene plant in the engineering stage. Engr: Lummus Crest. Completion: 1992.

***TPI. Cilacap, Java.** 180,000 mt/y polypropylene plant. Completion: 1991.

## IRAN

***FIPCO. Esfahan.** 60,000 mt/y dimethyl terephthalate under construction. Contr: Krupp Koppers. Completion: 1992.

**IRAN CHEMICAL INDUSTRIES INVESTMENT CO. Esfahan.** 50,000 mt/y linear alkyl benzene unit under construction. Contr: Snamprogetti. Completion: 1992.

**NATIONAL PETROCHEMICAL CO. Arak.** 24,000 mt/y acetaldehyde plant in engineering stage. Contr: Uhde. Lic: Aldehyd. Completion: 1992.

30,000 mt/y acetic acid plant in engineering stage. Contr: Uhde. Lic: Hoechst. Completion: 1992.

30,000 mt/y vinylacetate monomer plant in engineering stage. Contr: Uhde. Lic: Bayer. Completion: 1992.

240,000 mt/y ethylene plant under construction. Contr: TPL. Completion: Dec. 1991.

60,000 mt/y lld polyethylene plant under construction. Contr: TPL. Completion: Sept. 1991.

60,000 mt/y hd polyethylene plant. Contr: Uhde. Completion: 1992.

105,000 mt/y pyrolysis gasoline hydrogen plant in the engineering stage. Completion: Dec. 1991.

**Bandar Khomeini.** 1.3 million mt/y LPG unit and three utilities. Reconstruction. Contr: Lummus Crest of Holland and Krupp Koppers of West Germany.

***Esfahan.** Aromatics plant under construction. Contr: Tecnicas. Completion: 1991.

**Tabriz.** 136,000 mt/y olefins plant in engineering stage. Contr: TPL. Completion: Oct. 1992.

136,000 mt/y ethylene plant in engineering stage. Contr: KTI/TPL. Completion: 1993

## IRAQ

**IRAQ OIL. Central Iraq. South of Baghdad.** $2 billion petrochemical complex No. 2. Products include: 450,000 mt/y ethylene (feed: Naphtha); 160,000 mt/y polyethylene; 100,000 mt/y polypropylene; and 120,000 mt/y polystyrene. Consult: Bechtel UK on ethylene unit. Proposed. Completion: Possible 1992.

**MINISTRY OF INDUSTRY. Beiji.** 1,000 mt/d ammonia and 1,750 mt/d urea expansion in the engineering stage. Feed: Natural gas. Contr: MW Kellogg. Completion: 1992.

**NATIONAL PETROCHEMICAL. Tabriz.** 336,000 mt/y ethylene production plant. Contr: TPL. Completion: Oct. 1992.

Olefins plant in the engineering stage. Contr: TPL. Completion: Oct. 1992.

**TECHCORPS. Central Iraq. South of Baghdad.** 100,000 mt/y polypropylene plant under construction. Contr: Tecnimont. Completion: 1991.

**Hilla.** 450,000 mt/y ethylene plant in the engineering stage. Contr: Bechtel. Completion: 1992.

**Latifia.** 67,000 mt/y ethylene oxide/glycol plant in the engineering stage. Lic: Scientific Design. Completion: Jan. 1992.

***Mussayyib.** 60,000 mt/y chloralkali plant in the engineering stage. Contr: Tecnimont. Completion: 1992.

**TECHNICAL CORPS FOR SPECIAL PROJECTS.** 70,000 mt/y butadiene extraction plant. Contr: Toyo Engineering Corp. Completion: 1991.

## ISRAEL

**GADOT PETROCHEMICAL INDUSTRIES LTD. Haifa Bay.** 30,000 mt/y paraxylene plant. Feed: Xylenes.

30,000 mt/y paraxylene expansion. Feed: Xylenes.

## ITALY

***ACETATI. Pallanza.** 44,000 mt/y acetic anhydride plant under construction. Engr: Tecnimont. Completion: 1991.

***ALUSUISSE ITALIA SPA. Ravenna.** 50,000 mt/y maleic anhydride plant planned. Feed: N-butane. Completion: 1991.

***DUTRAL. Ferrara.** 25,000 mt/y synthetic rubber plant under construction. Engr: Tecnimont. Completion: 1991.

**ENICHEM. Manfredonia.** 1,500 mt/y ammonia washing in the engineering stage. Engr: Techint. June 1991.

**Augusta.** 240 mt/d kerosene feed pretreatment expansion under construction. Eng: CTIP.

**Brindisi.** 400,000 mt/y ethylene plant. Contr: KTI/Technipetrol. Completion: 1991.

**ENICHEM ANIC. Assemini.** 85,000 mt/y acrylonitrile expansion in engineering stage. Contr: TPL. Completion: June 1991.

***Brindisi.** 400,000 mt/y ethylene under construction. Contr: TPL. Completion: Aug. 1992.

**Gela.** 100,000 cum/h WSA-$SNO_x$ under construction. Contr: Snamprogetti. Completion: 1992.

**ENIMONT. Brindisi.** Cracking plant with capacities of 400,000 mt/y of ethylene, 200,000 mt/y of propylene, and 90,000 mt/y of butane fractions.

**ESSO ITALIANA. Augusta.** Revamp of various units under construction. Contr: Foster. Completion: March 1991.

**IGI SUD. Manfredonia.** 5,000 mt/y argon and hydrogen recovery in the engineering stage. June 1991.

***MONTEDIPE. Mantua.** 150,000 mt/y ethylbenzene plant under construction. Engr: Tecnimont. Completion: 1991.

***SIPET SpA. Frosinone.** 63,000 mt/y polyester polycondensation plant in the engineering stage. Contr: Zimmer. Completion: 1992.

**SOLVAY & CO. Rosiguano.** 45,000 mt/y polyethylene finishing units in the engineering stage. (natural PE & black PE). Completion: Oct. 1993.

***TECONYLON. Cerianc L.** 30,000 mt/y nylon 6.6 polymerization plant under construction. Engr: SNIA Engr. Completion: 1991.

## JAPAN

**DAICEL CHEMICAL INDUSTRIES LTD. Shizuoka.** 20,900 mt/y formalin plant. Contr: Toyo Engineering Corp. Lic: Mitsui Toatsu.

***IDEMITSU PETROCHEML CO. Chiba.** 120,000 mt/y ethylene plant in the engineering stage. Engr: Kellogg. Contr: Kawasaki. Completion: 1991.

*50,000 mt/y polypropylene plant in the engineering stage. Design: Uhde Gmbh.

***MISUBISHI KASEI. Mizushima.** 60,000 mt/y polypropylene plant. Completion: 1991.

**MITSUBISHI TOATSU CHEMICALS INC. Osaka.** 1,000 mt/d retrofit of ammonia converter. Engr: Toyo Engineering Corp. Lic: Kellogg.

**MITSUBISHI PETROCHEMICAL CO. Kashima.** 450,000 mt/y ethylene plant in the engineering stage. Completion: 1993.

*80,000 mt/y polypropylene plant. Completion: 1992.

**NIHON POLYSTYRENE CO. LTD. Kawasaki.** 30,000 mt/y polystyrene expansion under construction.

***NIPPON SHOKUBAI KAGAKU KOGYO CO. Chiyodaku.** 60,000 mt/y acrylic acid, 25,000 mt/y ethylene glycol, and 25,000 mt/y ethylene oxide expansion.

**OSAKA PETROCHEMICAL INDUSTRIES LTD. Takaishishi, Osaka.** 60,000 mt/y ethylene expansion. Feed: LPG, naphtha, heavy oil. Planned.

**SHOWA DENKO K.K.. *Ohita.** 60,000 mt/y polyethylene plant. Completion: 3rd Qtr. 1991.

**TONEN SEKIYUKAGAKU KK. Kawasaki.** 20,000 mt/y Butanediol plant in the engineering stage. Design & Engr: Davy McKee. Completion: Late 1991.

*35 mt/y maleic anhydride plant in the engineering stage. Completion: 1992.

***TOSOH CORP. Yokkaichi.** 150,000 mt/y ethylene expansion. Completion: 1993-95.

*70,000 mt/y polypropylene plant. Completion: 1992.

## KOREA

**BP CHEMICALS.** Acetic acid plant planned.

**DEMOCRATIC PEOPLE'S KOREAN REPUBLIC.** 10,000 mt/y ethylene oxide-glycol plant. $6.5 MM. Contr: Japan Catalytic Chemical and Hitachi Shipbuilding & Engineering.

**DONG SUNG CHEMICALS INDUSTRIES LTD. Korea.** 20,000 mt/y Butane plant under construction. Engr: Davy McKee. Completion: 1991.

**HAN YANG CHEMICAL CORP. Yeochun.** 350,000 mt/y ethylene plant in the engineering stage. Feed: Naphtha. Product: BTX (80,000 mt/y). Contr: Stone & Webster USA. Completion: March 1991.

70,000 mt/y polyvinyl chloride plant. Feed: Vinyl chloride. Contr: Kane Ka Fuchi. Planned. Completion: June 1992.

350,000 mt/y naphtha cracking plant. Contr: Stone & Webster.

4,200 b/d hydrodealkylation plant in the engineering stage. Design: HRI.

***HANIL SYNTH. FIBRE. Masan.** 14,000 mt/y acrylic fibre plant under construction. Completion: 1991.

**HONAM PETROCHEMCIAL CORP. Yoesu.** 350,000 mt/y ethylene plant under construction. Contr: Toyo Engineering Corp.

**HYUNDAI PETROCHEMICAL. Daesan.** 350,000 mt/y ethylene plant in engineering stage. Feed: Naphtha, gas oil, LPG. Liceng: MW Kellogg. $300 MM. Completion: 1991.

60,000 mt/y low linear density polyethylene plant in the engineering stage. $80 MM. Engr: John Brown. Completion: 1991.

57,000 mt/y butadien extraction plant. Contr: Toyo Engineering Corp.

170,000 mt/y polypropylene plant. Lic: Hilmont Inc. Completion: Late 1991.

*100,000 mt/y ethylene glycol plant under construction. Lic: Scientific Design. Completion: 1991.

**Ulsan.** Styrene-butadiene-Acrylonitrile/methyl ethyl ketone plant in the engineering stage. Engr: Edeleanu. Completion: 1992.

***ISU CHEMICALS. Onsan.** 200,000 mt/y polypropylene plant. Completion: 1991.

**KOC. Korea.** 300 mt/d nitric acid plant. Contr: Uhde Gmbh. Completion: 1991.

***KOHAP CHEMICAL CORP. Seone.** 65 mt/d nylon 66 chips under construction. Contr: Davy McKee. Completion: 1991.

**KOREA PETROCHEMICAL INDUSTRIES CO. LTD. Onsan.** 250,000 mt/y polymer grade ethylene and 145,000 mt/y propylene plant. Tech. Lummus Crest.

**KUMHO SHELL CHEMICAL CO. LTD. Yeochun.** 180,000 mt/y styrene plant. Design/Engr: Lummus Crest. Tech: Monsanto/ Lummus Crest.

**LUCKY PETROCHEMICAL LTD. Yeochon.** 140,000 mt/y $C^4$ hydrogenation unit in the engineering stage. Completion: Mid-1991.

**SAMSUNG GENERAL CHEMICALS CO. LTD. Daesan.** 260,000 mt/y benzene/toluene plant in the engineering stage. Lic: Krupp Kopper. Completion: 1991.

*80,000 mt/y ethylene oxide/glycol plant under construction. Lic: Scientific Design. Completion: 1991.

**Seosang.** $20 million aromatics complex. Products: toluene, xylene, and ethylbenzene for conversion to 140,000 mt/y of benzene. Completion: summer 1992.

***Seosa.** 31,000 mt/y isobutylene unit. Completion: 1991.

**TONGYANG NYLON. Ulsan, South Korea.** 165,000 mt/y polymer grade propylene. Lic: UOP.

**YUKONG LTD. Ulsan.** 35,000 mt/y isopropanol plant and 50,000 mt/y secondary butanol/ methyl ethyl ketone unit in the negineering stage. $72 MM. Design/Engr: Edeleanu GmbH. Completion: 1992.

## KUWAIT

**KUWAIT NATIONAL PETROLEUM CO. Mina Al-Ahmadi.** 1,300 mt/y MTBE unit. Lic: IFP. Completion: End 1992.

90,000 mt/y propylene unit planned. Completion: End 1992.

**PETROCHEMICAL INDUSTRIES. Shuaiba.** 80,000 mt/y polypropylene unit. Feed: Propylene. Lic: Union Carbide. Completion: 1992.

100,000 mt/y polypropylene unit. Feed: Propylene. Planned. Completion: 1991.

## LIBYA

***RAS LANUF OIL & GAS PROCESSING CO. Ras Lanuf.** 80,000 mt/y HD polyethylene and 80,000 mt/y LLd polyethylene plant in the engineering stage. Completion: Feb. 1993.

## MALAYSIA

**ASEAN BINTULU FERTILIZER SDN. BHD. Bintulu.** 66,000 mt/y synthesis gas/ammonia expansion under construction. Design: Uhde. Completion: 1991.

**BP CHEMICALS.** Low linear density polyethylene plant. Planned.

**EXXON CHEMICAL CO. Kerteh.** 450,000 mt/y ethylene and 450,000 mt/y polyethylene plant awaiting gov't approval. Completion: 1994.

**MTBE MALAYSIA. Kuantan.** (joint venture with Petronas, Idemitsu Petrochemical and Neste Oy) 80,000 mt/y polypropylene, 80,000 mt/y propylene and 300,000 MTBE plants in the engineering stage. Design/Engr: Kellogg. Contr: Stone & Webster. Completion: 1992.

***PAN-CENTURY OLEOCHEMICALS SDN BHD. Pasir Gudang Johor.** 60,000 mt/y oleochemicals plant in the engineering stage. Engr: Davy Powergas India. Completion: 1992.

**PETROLIAM NASIONAL BHD.** seeking bids for three plants. 300,000 mt/y MTBE plant. 80,000 mt/y propylene plant. 80,000 mt/y polypropylene plant.

**PETRONAS. Kuantan.** 80,000 mt/y polypropylene plant in the engineering stage. Completion: 1992.

80,000 mt/y propylene plant in the engineering stage. Completion: 1992.

300,000 mt/y MTBE plant in the engineering stage. Completion: 1992.

**POLYPROPYLENE MALAYSIA. Kuantan.** (joint venture with Petronas, Idemitsu Petrochemical, and Neste Oy) 80,000 mt/y polypropylene plant. Planned.

**SHELL MDS (MALAYSIA). Bintulu.** 500,000 mt/y middle distillates synthesys. Contr: JGC. Completion: 1992.

**TITAN POLYPROPYLENE (MALAYSIA) SDN. BHD.. Johor.** 100,000 mt/y polypropylene. Design: Tecnimont. Contr: JGC. Completion: 1991.

## MEXICO

**CELANESE MEXICANA. Cangrejera, Veracruz.** 60,000 mt/y vinyl acetate plant. Feed: Ethylene, acetic acid. Completion: 1991.

100,000 mt/y butyraldehyde, 5,400 mt/y isobutyraldehyde units. Feed: Propylene. Completion: 1991.

*30,000 mt/y acrylic acid plant. Feed: propylene.

*4,600 mt/y polyester expansion. Completion: 1991.

**DERIVADOS MALEICOS SA DE CV. Apizaco, Tlaxcala.** 15,000 mt/y maleic anhydride unit. Feed: Benzene. Completion: End 1992.

**FERTILIZANTES MEXICANOS. Camargo.** 1,500 mt/d urea plant Engr: Latisa Contr: Snamprogetti. Completion: 1992.

**Lazaro Cardenas.** 1,500 mt/d urea plant under construction. Engr: Latisa Contr: Snamprogetti. Completion: 1992.

***FINACRIL. Tampico.** 14,000 mt/y acrylic fibre expansion under construction. Completion: 1992.

***INDALPRO. Altamina.** 100,000 mt/y polypropylene plant. Completion: 1991/92.

**Tampico.** 100,000 mt/y polypropylene plant under construction. Contr: Tecnimont. Completion: 1991.

**PEMEX. Morelos.** 100,000 mt/y hd polyethylene unit under construction. Feed: Ethylene.

500,000 mt/y ethylene unit under construction. Feed: Refinery gas.

350,000 mt/y propylene unit under construction. Design: Air Products. Completion: 1991.

75,000 mt/y isopropyl alcohol unit in engineering stage. Completion: 1991.

**SINTESIS ORGANICAS SA DE CV. Apizaco, Tlaxcala.** 15,000 mt/y plastizicers unit. Feed: 2-ethyl hexanol. Completion: End 1992.

## NETHERLANDS

***DSM. Herleen.** 145,000 mt/y polypropylene. Completion: 1991.

**EXXON. Rotterdam.** 57,000 mt/y phthalic anhyd. unit under construction. Design: Lurgi GmbH. Completion: March 1991.

**SHELL NEDERLAND CHEMIE BV. Moerdijk, Netherlands.** 363,000 mt/y ethylbenzene plant in the engineering stage. Tech: Mobil/Badger. Contr: KTI. Completion: Late 1991.

## NIGERIA

**NIGERIA LNG LTD. Rivers State.** 4 million mt/y LNG. Technip/Snamprogetti Spa Tealarc liquefaction process. $2.5 billion. Specification preparation: Technip/Kellogg. Completion: 1993.

**NIGERIAN NATIONAL PETRO. CO. Eleme.** Phase Two of petrochemical complex. 250,000 mt/y LD & HD polyethylene, 80,000 mt/y polypropylene, 260,000 mt/y ethylene, 82,000 mt/y propylene and 20,000 mt/y butadiene plant. $1.2 billion. Contr: Du Pont Canada and IFP.

## NORWAY

**Statoil. Antwerp.** 400,000 mt/y propylene plant and 180,000 mt/y polypropylene unit. pr: 1990, po: 1991.

**Den norske stats oljeselskap AS. Bamble.** 40,000 mt/y expansion of their hd polyethylene plant. $23.9 MM.

## PAKISTAN

**FAUJI FERTILIZER CO. Machhi Goth.** 1,215 mt/d ammonia plant and 2,105 mt/d urea plant under construction. Contr: Snamprogetti. Completion: 1992.

1,000 mt/d ammonia expansion and 1,925 mt/d urea expansion under construction. Contr: Snamprogetti. Completion: 1992.

## OMAN

**Oman government.** 2,220 mt/y floating methanol plant. $250 MM. Tenders out. Completion: 1991.

## PHILIPPINES

**LUZON PETROCHEMICAL CORP. Batangas.** 140,000 mt/y lld and hd polyethylene, 110,000 mt/y of polyproylene plant. Contr: Mitsubishi Corp. Tech: Unipol process. (joint venture lead by USI Far East Corp.)

230,000 mt/y ethylene plant in the engineering stage. Contr: Toyo Engineering Corp. and Nissho Iwai Corp. Completion: Late 1992.

## PORTUGAL

***CIA NACIONAL PETROCHIMICA'S. Sines.** 50,000 mt/y ethylene cracker. Completion: 1992.

***EMPRESA DE POLIMEROS DE SINES. Sines.** 40,000 mt/y HD polyethylene expansion and build a compounding unit on the site. Completion: 1992.

## SAUDI ARABIA

**AMOCO AND SAUDI CHEMICAL INVESTMENTS LTD.** Feasibility study of building an aromatics complex. 400,000 mt/y paraxylene plant and a BTX extraction unit.

**ARABIAN PETROCHEMICAL CO. Al Jubaul.** 133,000 mt/y benzene plant in the engineering stage. Design: Air Products. Completion: 1991.

*500,000 mt/y ethylene project in the engineering stage. Lic: Kellogg.

**IBN HAYYAN. Al Jubail.** 100,000 mt/y polyvinyl chloride expansion under construction. Contr: Badger. Completion: 1991.

**MOBIL CHEMICAL CO./SAUDI BASIC INDUSTRIES CORP. Yanbu.** Installation of 2 ethylene furances, 50,000 mt/y polyethylene and 80,000 mt/y ethylene glycol expansion.

**SAUDI METHANOL CO. Al-Jubail.** 560,000 mt/y increase of methanol plant. Total capacity 1.2 million mt/y. (joint venture of Saudi Basic Industries Corp. and a japanese group led by Mitsubishi Gas Chemical.

## SOUTH AFRICA

**NATIONAL CHEMICAL PRODUCTS LTD. Durban.** 6,000 mt/y maleic anhydride plant under construction. Feed: Butane. $17 MM U.S.

## SOUTH SUMATRA

***PUSRI. Palembang.** 1,350 mt/d ammonia plant in the engineering stage. Engr: Kellogg. Contr: Kellogg/Rekayasa. Completion: 1992.

## SPAIN

**ATOCHEM. Prat de Llobregat.** 120,000 mt/y polyvinyl chloride plant. $60 MM. Planned. Completion: 1990-1991.

20,000 mt/y polystyrene expansion planned (75,000 mt/y total cap.).

***BASF. Tarragona.** 50,000 mt/y polypropylene plant. Completion: 1991.

**BAYER HISPANIA INDUSTRIAL SA. Tarragona.** Expansion of the following: 36,000 mt/y isocynates, 11,000 mt/y ABS/SAN resins, 1,200 mt/y synthetic latex. $80 MM. Completion: 1991.

**BP CHEMICALS LTD./CIA. ESPANOLA DE PETROLEOS SA. San Roque.** 30,000 mt/y maleic anhydride plant. $50 MM. Completion: 1991.

**Algeciras.** 45,000 mt/y MTBE unit. Lic: UOP.

**E.I. du PONT de NEMOURS INC. Barcelona.** Polymers/composite materials plant. $80 MM. Completion: 1992.

***Oviedo, Asturias.** $1 billion petrochemical complex to produce engineering plastics, advanced fibers, and other products. Completion: 1992.

***ERCROS SA. Cartagena.** 880 mt/d revamp of ammonia plant.

***Puertollano.** 600 mt/d revamp of ammonia plant.

**ENFERSA. Puertollano.** 420 mt/d urea expansion under construction. Feed: Ammonia. Contr: Snamprogetti. Completion: 1990.

**GE PLASTICS DE ESPANA SA. Cartagena.** acrylonitrile butadiene styrene plant. $2.5 billion. Contr: Foster Wheeler Iberia SA.

**HIMONT** (Hercules Inc. and Montedison SpA). 25,000 mt/y polypropylene plant. Planned.

***HISPAVIC-SOLVAY. Martorell.** 55,000 mt/y polyvinyl chloride in the engineering stage. Contr: Tecnicas. Completion: 1991.

**POLIPROPILENO DE GALICIA SA. El Ferrol.** 50,000 mt/y polypropylene plant planned. Completion: Early 1991.

**PRODUCTOS QUIMICOS DEL MEDITERRANEO SA.** 20,000 mt/y caprolactam expansion. Feed: Cyclohexane. Planned.

**REPSOL PETROLEO. Bibao.** 100,000 mt/y polypropylene plant. Completion: 1992.

**La Coruna.** 160,000 mt/y hydrogenation butadiene plant. Completion: 1991.

**Puertollano.** 20,000 mt/y styrene expansion. Planned.

25,000 mt/y ld polypropylene expansion.

130,000 mt/y alkylation unit. Contr: Phillips. Completion: 1991.

**Tarragona.** 27,000 mt/y propylene plant. Completion: 1991.

1,400 mt/d olefins unit being revamped. Contr: Repsol/Linde.

250,000 mt/y fractionation gasoline pyrolysis. Contr: Repsol.

*70,000 mt/y ethylene expansion. Engr: Linde. Completion: 1991.

**TARRAGONA QUIMICA SA. Tarragona.** 25,000 mt/y hd polyethylene expansion (125,000 mt/y total cap.) $65 MM.

## SWEDEN

**NOBEL CHEMATUR. Stenungsund.** 40,000 mt/y ethylene unit (from ethanol) in engineering stage. Design: Scientific Design.

## TANZANIA

**KILWA AMMONIA CO. Kilwa Masoko.** $400 MM ammonia plant. Feed: Natural gas (from Songo Songo Island field).

## THAILAND

**CHIEM PATTANA KNITTING CO. LTD. Ratchaburi.** 42,000 mt/y polyester polycondensation in the engineering stage. Contr: Zimmer. Completion: 1992.

***DOW CHEMICAL. Rayong province.** 25,000 mt/y polyurethane plant. Compeltion: 1992.

***HMT POLYSTYRENE. Rayong.** 25,000 mt/y polystyrene plant. Completion: 1991.

**ICI INDUSTRIES plc AND SAHA UNION. Rayong province.** (joint venture) 205,000 b/d purified terephthalic acid plant. Planned. Completion: 1992.

**PETROLEUM AUTHORITY OF THAILAND. Rayong.** Petrochemical complex 2: 500 MM lb/y aromatics and olefins. Eng. study/contr: Bechtel and Chem Systems. $1 billion. Completion: 1992.

***SUN FLAG (THAILAND) LTD. Aynthaya.** 3,650 mt/y polyster resins in the engineering stage. Contr: Davy McKee. Completion: 1992.

*35,000 mt/y polyester polycondensation plant in the engineering stage. Contr: Zimmer. Completion: 1992.

**THAI CHAROEN POKPHAND GROUP. Ma Ta Phut.** (joint venture with Solvay Group) 135,000 mt/y polyvinyl chloride plant. Contr: Solvay.

**THAI OLEFINS CO. Rayong province.** 350,000 mt/y ethylene and 170,000 mt/y propylene plant. Engr: Bechtel. Compeltion: Mid-1993.

**Mapta Phut.** 600,000 mt/y NPC-2 olefins plant in the engineering stage. Contr: Bechtel. Completion: 1993.

***TPI. Rayong.** 15,000 mt/y polystryene plant in the engineering stage. Engr: Uhde GmbH.

## TRINIDAD

**CARIBBEAN METHANOL CO. Point Lisas.** 550,000 mt/y methanol plant in the engineering stage. Completion: 1992.

**GOVERNMENT OF TRINIDAD-TOBAGO** (51%), **MW KELLOGG** (24.5%), **NORSK HYDRO** (24.5%). **Point Lisas.** 1,500 mt/d ammonia plant. Contr: Kellogg.

***TRINIDAD & TOBAGO METHANOL CO.** 1,380 mt/d methanol revamping in the engineering stage. Contr: Toyo Corp. Completion: 1992.

## TUNISIA

***IMPOL. Hamman Lif.** 44,000 mt/y polystyrene plant in the engineering stage. Engr: Tecnimont. Completion: 1992.

## TURKEY

***PETKIM.** ld polyethylene expansion in the engineering stage. Contr: Simon.

***POLIPET. Gaziantep.** 80,000 mt/y polypropylene plant. Completion: 1991/92.

## UNITED KINGDOM

**BITMAC. Southampton.** 2,000 mt/y phthalic anhydride expansion in engineering stage. Contr: Lurgi.

**BP CHEMICALS LTD. Barry.** pheolics resins plant under construction. Contr: John Brown. Completion: 1991.

**Hull. Grangemouth, Scotland.** 350,000 mt/y ethylene unit in the engineering stage. Design/Engr: Stone & Webster. Completion: 1991.

100,000 mt/y hd polyethylene expansion in engineering stage (250,000 mt/y total capacity).

600,000 total capacity of olfins. Design: Stone & Webster.

**EXXON CHEMICAL LTD. Fife.** Hiking ethylene capacity to 900,000 mt/y and adding a polymer grade propylene capacity of 180,000 mt/y. $316 MM. Completion: 1992.

***EXXON/SHELL. Mossmorran, Scot.** 250,000 mt/y ethylene expansion in the engineering stage. Engr: Kellogg.

**SHELL CHEMICALS UK LTD. Carrington.** *130,000 mt/y LD polyethylene plant. Engr/Contr: Kellogg. Completion: 1991.

## U.S.S.R.

**Dzerzhinsk.** 25,000 mt/y acrylic acid, 40,000 mt/y acrylic esters, 40,000 mt/y acrylic emulsions in engineering stage. Processes: Nippon Shokubai KK, Dainippon Inc. Consortium coordinator: Nissho Iwai. Contr: Mitsubishi HI. Completion: March 1991.

**Kazan.** 200,000 mt/y polyethylene expansion. Union Carbide technology. Contr: John Brown.

**MINISTRY OF THE PETROCHEMICALS INDUSTRY AND ENI. Lithuania.** (joint venture) 350,000 mt/y MTBE and 150,000 mt/y alkylates plant. Planned.

**Nizhnevartovsk, Siberia.** Petrochemical complex. Feed: Ethylene. $5 billion. Feasibility study: Mitsubishi, Mitsui, Chiyoda. Completion: Late 1990's.

**Polotsk.** 60,000 mt/y ethylene-propylene and 55,000 mt/y acrylonitrile.

**PRESSINDUSTRIA. Tobolsk.** 90,000 mt/y butyl rubber plant in the engineering stage. Contr: Techint. Completion: June 1993.

***SOJUZAGROCHIMEXPORT. Chirchik.** 8,000 mt/y caprolactam expansion in the engineering stage. Engr: SNIA Engr. Completion: 1992.

**SOVIET MINISTRY OF THE CHEMICAL INDUSTRY. Shevchenko.** Petrochemical complex. Contr: Dow Europe-Litwin. Feasibility study.

**STAVROPOL POLYMER. Budyennovsk.** 100,000 mt/y expansion of their olefin plant in the engineering stage. Tech: Linde. Completion: 1992.

**TECHMASHIMPORT. Budennowsk, Caucasus.** 100,000 mt/y ethylene expansion at Stavropoi polymer complex. Contr: Linde AG.

**Budyennorsk.** 100,000 mt/y polypropylene expansion under construction. Contr: John Brown. $95 MM. Completion: 1991.

*100,000 mt/y polyproplyene expansion under construction. $175 M. Contr: John Brown. completion: 1991.

**Blagoveshchensk.** 230,000 mt/y pure terephthalic acid in engineering stage. Contr: MES. Completion: 1992.

**Mogilev.** 25,000 mt/y dimethyl terephthalate modernization, expansion in the engineering stage. Contr: Krupps Koppers. Completion: 1992.

**Nevinnonysk.** 150,000 mt/y acetic acid under construction. Contr: MES. Completion: 1990.

**Saratov.** 75,000 mt/y expansion. Acrylonitrile. Engineering stage. Contr: Techimont. Completion: 1991.

**Voronej.** 30,000 mt/y thermoplastic styrene-butadiene elastomers plant planned. Contr: Litwin SA France. Completion: 1991.

500,000 mt/y ethylene revamping. Contr: Toyo Engineering Corp.

## VENEZUELA

**CORPOVEN. El Palito.** 2,500 b/d revamp BTX unit. Engr/Lic: UOP. $100 MM. Completion: 1990.

**DOW CHEMICAL CO. El Tablazo.** 150,000 mt/y styrene monomer plant. $120 MM. (joint venture with Petroquimica de Venezuela and Grupo Zuliano).

**NITRORIENTE. Anzoátegui.** 495,000 mt/y ammonia unit. Lic/Engr: Braun. $250 MM. Completion: 1991.

**PEQUIVEN. Moron Complex.** 500,000 mt/y ammonia and 500,000 mt/y urea expansion.

***Zulia Complex.** 60,000 mt/y ethylene glycol, 16,000 mt/y ethylene oxide, 150,000 mt/y styrene, 130,000 mt/y vinyl chloride, 150,000 mt/y polyethylene, 70,000 mt/y polypropylene, 120,000 mt/y polyvinyl chloride, 350,000 mt/y ethylene and 130,000 mt/y propylene expansion.

**El Tablazo, Zulia.** Olefins plant expansion (250,000 mt/y ethylene and 125,000 t/y propylene) in the engineering stage. Feed: Ethane. Engr: Kellogg. Contr: Inelectra/Kellogg. Completion: 1991.

60,000 mt/y ethylene dichloride and vinyl chloride units planned. Feed: Ethylene, chloride. Completion: 1992.

**Morón, Carabobo.** 495,000 mt/y ammonia unit planned. Lic/Engr: Braun. Feed: Natural gas. Completion: 1991.

247,500 mt/y urea unit planned. Feed: Ammonia. Completion 1991.

308,000 mt/y solution urea. Feed: Ammonia. Planned. Completion: 1991.

***PEQUIVEN/ECOFUEL. Jose.** 2,000 mt/d methanol plant in the engineering stage. Engr: Davy McKee. Completion: 1993.

**PETROPROPANO DE VENEZUELA S.A. Jose.** (joint venture of Petroquimica de Venezuela and Veba Oel AG) 250,000 mt/y propylene unit. Feed: Propane. Eng-design: UOP.

***PRALCA. Punta Camacho, Estado Zulia.** 16,000 mt/y purified ethylene oxide, 66,000 mt/y monoethylene glycol, 6,300 mt/y diethylene glycol, 290 mt/y triethylene glycol in the engineering stage. Contr: TPL. Completion: Aug. 1992.

***PROPILVEN. El. Tablazo.** 70,000 mt/y polypropylene plant. Completion: 1991.

**SUPER OCTANOS C.A. Jose.** 500,000 mt/y MTBE plant under construction. Contr: Snamprogetti. Completion: 1991.

320,000 mt/y Isobutylene plant under construction. Design: Air Products. Completion: 1991.

## YUGOSLAVIA

***JUGOVINIL. Kastel Sucurac, Split.** 85,000 mt/y polyvinyl chloride in the engineering stage. Feed: vinyl chloride monomer.

***PRVA ISKRA. Baric, Belgrade.** 20,000 mt/y toluene plant. Feed: Natural gas, toluene.

*50,000 mt/y linear alkylbenzene plant. Feed: N-paraffins, benzene.

**PROGRES PRIZREN. Prizren.** 7,000 mt/y polyamide 6 polymerization unit in engineering stage. Contr: Zimmer Ag

# Sulfur — WORLDWIDE CONSTRUCTION

*Designates projects listed for the first time in the Journal.

## UNITED STATES

**ASHLAND PETROLEUM. Catlettsburg, Ky.** 203.2 t/d Claus unit (from refinery). Engr: Pritchard. Contr: Foster Wheeler. Completion: Spring 1991.

**St. Paul, Minn.** 50 t/d (from refinery). Process: Pritchard. Completion: Fall 1992.

**Canton, Ohio** 50 t/d (from refinery). Process: Pritchard. Completion: Spring 1992.

**BP OIL CO. Ferndale, Wash.** Sulfur recovery unit expansion in the engineering stage. Desgin: Parsons. Completion: 1990.

***MOBIL OIL CORP. Beaumont, Tex.** 200 t/d sulfur expansion. Completion: 1992.

**MOBIL OIL EXPLORATION & PRODUCTION U.S. Coden, Ala.** 5 t/d amine/sulfur recovery expansion under construction. (from natural gas) Contr: Randall. Completion: June 1991.

**PENNZOIL PRODUCTS. Roosevelt, Utah.** 0.35 t/d Locat unit.

**SHELL OIL. Anacortes, Wash.** 17 t/d design (from refinery).

## SULFUR

**Denver City, Tex.** 5 t/d design (from natural gas).

**SUN RESEARCH & MARKETING. Philadelphia, Pa.** 100 t/d sulfur recovery unit in the engineering stage. Contr: Parsons. Completion: 1990.

***QUAKER STATE. Newell, W.V.** 1.25 t/d fuel gas expanion. Sulferox process. Completion: March 1991.

**QUANTUM. Deer Park, Tex.** 17,500 t/y acetylene recovery unit under construction. Contr: Linde. Completion: 1990.

**UNOCAL. Arroyo Grande, Calif.** Revamp of existing Coker gas & water stripping plant with Claus process. Contr: C.F. Braun. Completion: 1992.

### ABU DHABI

**ABU DHABI NATIONAL OIL CO.** 500 mt/d each, 2 units sulfur granulation being revamped. Contr: Snamprogetti. Completion: 1991.

750 mt/d sulfur granulation unit under construction. Contr: Snamprogetti. Completion: 1991.

*23 mt/d sulfur recovery plant under construction. Contr: Snamprogetti. Completion: 1992.

### BELGIUM

**NV TESSENDERLO CHEMIE. Ham.** 1,000 mt/d sulfuric acid plant under construction. Contr: Simon-Carves. Completion: 1991.

### BRAZIL

**PETROBRÁS. Araucaria, PR.** 65 mt/d claus unit (from refinery). Contr: Staff. Completion: 1992.

**Canoas, RS.** 35 mt/d Claus unit (from refinery). Contr: Staff. Completion: 1992.

**Cubatao, SP.** 70 mt/d claus unit (from refinery). Contr: Staff. Completion: 1991.

**Mataripe, BA.** 40 mt/d Claus unit (from refinery). Planning.

**Paulínia, SP.** 65 mt/d Claus unit (from fuel gas and LPG desulf). Eng: Promon. Lic: Kellogg. Contr: Staff. Completion: 1991.

### CANADA

**HUSKY OIL OPERATIONS. Lloydminster, Alta./Sask.** 290 mt/d heavy oil upgrader sulfur recovery plant in the engineering stage. Engr/Procurement: Monenco Ltd. Completion: Nov. 1992.

**SHELL CANADA. Caroline, Alta.** 300 MMcfd expansion of 4,500 mt/d plant in engineering stage. Contr: Partec Lavalin Inc. Completion: 1991.

4,000 mt/d sulfur recovery unit awaiting approval. Engr: Delta Projects.

***WESTCOAST ENERGY INC. Fort St. John.** sulfur recovery unit. Contr: Fluor Daniel. Completion: Late 1991.

### CHINA

***CHINESE PETROLEUM CORP. Kaohsiung.** 246 mt/d sulfur expansion. Completion: 1990.

***Taoyuan.** 90 mt/d sulfur expansion. Completion: 1990.

**PANZHIHUA IRON & STEEL WORKS. Dukou.** 8,000 mt/y sulfuric acid plant under construction. Contr: Krupp Koppers. Completion: 1990.

### CHINA, TAIWAN

**CHINESE PETROLEUM CORP. Tor, Kor.** 972 mt/d sulfur degassing unit under construction. Design: Comprimo. Completion: 1990.

### COSTA RICA

**REFINADORA COSTARRICENSE DE PETROLEO. Puerto Limon.** 10,000 mt/d sulfur plant in the engineering stage. Contr: Dragados. Completion: 1992.

### CZECHOSLOVAKIA

**PKAZ.** 34 MMcfd unit under construction. Sulfint process. Contr: Integral.

### GERMANY, WEST

**MOBIL OIL AG. Woerth.** Two-stage Claus Sulfreen unit. Contr: Lurgi.

***RUHRKOHLE AG. Dortmund.** 10,000 mt/y sulfur plant in the engineering stage. Contr: Krupp Koppers. Completion: 1991.

***SAARBERGWERKE. Iurstenhausen.** 11,000 mt/y sulfuric acid unit under construction. Contr: Krupp Koppers. Completion: 1991.

### INDIA

**HINDUSTAN PETROLEUM CORP. Visakhapatnam.** 20,000 mt/d sulfur plant in the engineering stage. Completion: 1991.

### IRAN

**NIOC. Bandar Abbas.** 210 mt/d unit in the engineering stage Contr: Comprimo. Completion: 1990.

### ISRAEL

**OIL REFINERIES LTD. Ashdod.** 60 mt/d Claus TGT unit. Feed: FCC. Completion: 1992.

### JAPAN

**KAINAN PETRO. REFINING, Kainan.** 30 mt/d Superclaus under construction. Design: Comprimo. Completion: 1990.

**YUKONG LTD. Ulsan.** 400 mt/d sulfur plant in the engineering stage. Design: Comprimo. Completion: 1990.

400 mt/d sulfur degassing unit in the engineering stage. Design: Comprimo. Completion: 1990.

### JORDAN

**JORDAN PETROLEUM REFINERY.** 18 mt/d sulfur plant. Basic design study completed. Turnkey tender documents preparation - Claus. Feed: Refinery gases. Completion: 1991.

### KOREA

**YUKONG. Ulsan.** 400 mt/d sulfur/$SO^2$/$H^2S$ under construction. Design: Comprimo. Completion: 1990.

***KUKDONG. Daisan.** 180 mt/d Claus unit. Completion: Dec. 1992.

### KUWAIT

**KUWAIT NATIONAL PETROLEUM. Mina Al-Ahmadi.** 100 mt/d sulfuric acid regen. unit. Completion: End 1992.

### MEXICO

**PEMEX. Salina Cruz, Oax.** 32.9 mt/d Claus unit (from refinery gas). Engineering stage. Completion: 1991.

**Tula, Hgo.** 32.9 mt/d Claus unit (from refinery gas.) under construction. Completion: 1991.

### SAUDI ARABIA

**PETROMIN. Rabigh.** 120 mt/d sulfur recovery plant under construction. Engr: Snamprogetti. Completion: 1990.

### SWITZERLAND

**RAFFINERIE DE CRESSIER SA. Neuchatel.** 25 mt/d expansion in the engineering stage. Contr: Comprimo. Completion: 1990.

### THAILAND

**BANGCHAK PETROLEUM CO. LTD. Bangkok.** 30 mt/d in the engineering stage. Design: Comprimo. Completion: 1990.

### TURKEY

**TURKISH PETROLEUM REFINERIES CORP. Izmir.** 70 mt/d sulfur recovery plant (from refinery gas) under construction. Contr: Snamprogetti. Completion: 1992.

**Kirikkale.** 52 mt/d Claus unit (from refinery gas). Contr: JGC. Completion: 1992.

### VENEZUELA

**LAGOVEN, S.A. Amuay.** New sulfur recovery unit in the engineering stage. Engr: Parsons.

### YUGOSLAVIA

**INA—NAFTAPLIN. Molve.** 180 MMscfd MDEA, NGL recovery Dehy, Lo-Cat sulfur recovery in the engineering stage. Engr: Pitchard. Completion: 1990.

# Gas Processing—WORLDWIDE CONSTRUCTION

*Designates projects listed for the first time in the Journal.

### UNITED STATES

**ARCO ALASKA INC. Anchorage.** GHX-1 expansion of Prudhoe Bay field gas handling facilities. Design: RM Parsons. Completion: 1990.

**ARCO OIL & GAS. Fruitland, Colo.** Gas gathering dehydration. Completion: 1990.

**AMOCO PRODUCTION CO. Durango, Colo.** 250 MMcfd coal degas compression facilities. Engr: Davy McKee. Completion: Jan. 1991.

**Ulysses, Kan.** 400 MMscfd plant under construction. $140 million. Engr: Fluor Daniels Inc. Completion: 1992.

***Superior, Wis.** 10,000 b/d depropanization facility. Engr: Davy McKee. Completion: Sept. 1991.

**AMERADA HESS. Tiogaa, N.D.** Expansion of treating facility under construction.

**B.P. EXPLORATIONS. Prudhoe Bay.** Expansion of gas handling system in the engineering stage. Engr: Parsons. Completion: 1990.

**CHEVRON U.S.A. INC. Rangely, Colo.** 45 MMcfd compression expansion-Train III. Completion: Dec. 1990.

60 MMcfd NGL recovery plant. Completion: Feb. 1991.

**Lost Hills, Calif.** 70 MMcfd

stage. Engr: Parsons. Completion: 1990.

**CHEVRON U.S.A. INC. Rangely, Colo.** 45 MMcfd compression expansion-Train III. Completion: Dec. 1990.

60 MMcfd NGL recovery plant. Completion: Feb. 1991.

**Lost Hills, Calif.** 70 MMcfd LTS plant. Completion: Dec. 1991.

70 MMcfd $CO_2$ plant. Completion: Dec. 1991.

**Whitney Canyon/Carter Creek, Wyo.** 75 MMcfd south end compression addition. Completion: March 1991.

**EL PASO NATURAL GAS CO. West Texas.** Upgrade of compressor station in the engineering stage. Design: Fish. Completion: 1992.

***EXXON CO. Mobile Bay, Ala.** 300 MMscf/d sour gas treatment plant under construction. Contr: Zachry. Completion: June 1993.

***JAVELINA CORP. Corpus Christi, Tex.** 135 MMscfd refinery offgas processing expansion under construction. Contr: Fish. Completion: 1990.

**PANHANDLE EASTERN CORP. Liberal, Kan.** $25 million upgrade to extract 800 MMcf/y of crude helium. (joint venture with Air Products & Chemicals Inc.).

**PHILLIPS PETROLEUM CO. Tulsa, Okla.** Boost compression at it's 25 MMcfd Creek gas processing plant including two 1,160 hp compressors. Planning.

**SHELL OFFSHORE INC. Mobil, Ala.** 200 MMcfd sour gas treatment/processing plant. The plant will yield 60 long t/d of sulfur and some natural gas liquids. Engr: Davy McKee/BE&K Inc.. Completion: Nov. 1991.

**TEXACO INC. Erath, La.** 10,000 bbl expansion. Debutanizer. Under construction.

## ALGERIA

**SONATRACH. Bethioua near Arzew.** Revamp and improve LNG2 natural gas liquefaction complex. Contr: Kellogg.

***Rhourde Chouff.** 7 MM stcum/d gas gathering and conditioning under construction. Engr/Design: Snamprogetti. Completion: 1994.

## ARGENTINA

**YACIMIENTOS PETROLEUM FISCALES. Campo Duran.** 250 MMscfd LPG expansion in engineering stage. Product: LPG. Eng-design: Fish. Completion: 1990.

## AUSTRALIA

**WESFARMERS LPG PL. Kwinana.** 282.5 MMcfd plant. 190,000 mt/y LPG. Contr: Randall Corp./Clough. Engr:T. O'Connor & Sons PL-Adelaide.

**WOODSIDE OFFSHORE PETROLEUM PTL. Withnell Bay, Burrup Peninsula** (near Karratha). 2 MM mt/y LNG train No. 3 in design stage. 6 MM tons LNG total capacity. Contr: Kellogg/JGC/Kaiser. $900 MM. Completion: 1993.

## BANGLADESH

**BAKHRABAD GAS SYSTEMS LTD. *Feni gas field.** 40 MMscfd solid desicant gas dehydration plant. Planned.

## BRAZIL

***PETROBRAS. Amazonas.** 20 MMcfd gas processing plant in the planning stage. 43,600 gal/d LPG, 4,800 gal/d pentane plus. Completion: April 1991.

***Cubatão.** 77.3 MMcfd gas processing plant. In-house. Completion: Feb. 1992.

***Rio Grande Do Norte.** 39 MMcfd gas processing plant in the design stage. 166,400 gal/d LPG, 21,100 gal/d pentane plus. In-house. Completion: June 1993.

## CANADA

**AMOCO CANADA PETROLEUM CO. LTD. Empress, Alta.** 1,500 MMcfd revamp of Empress Straddle plant under construction. Completion: 1990.

**Nipisi, Alta.** Gas plant debottlenecking under construction. Completion: 1990.

**West Pembina, Alta.** 35 MMcfd natural gas plant expansion to 95 MMcfd in the engineering stage. Completion: 1991.

**GULF CANADA. Strachan, Alta.** Ethane recovery, NGL treating revamp and expansion in engineering stage. Design: Partec Lavalin. Completion: 1990.

**MOBIL OIL CANADA. Rainbow, Alta.** 20 MMcfd plant in engineering stage. Compression expansion method. $4.7 MM (US). Completion: 1990.

**PLACER CEGO PETROLEUM. Medicine Lodge, Alta.** 20-30 MMcfd plant. Preliminary design stage. Completion: Mid 1991.

**SHELL CANADA. Caroline, Alta.** 300 MMcfd expansion in engineering stage. EPC: Delta Projects Inc. Completion: 1992.

*Sour gas processing pilot plant. Contr: Cana Construction Ltd.

**TOTAL PETROLEUM CANADA LTD. Spirit River, Alta.** LO-CAT hydrogen sulfide oxidation process unit. Contr: Colt Engineering.

***WESTCOAST ENERGY INC. Fort St. John, B.C.** 105 MMcfd expansion of it's gas processing plant in the engineering stage. Contr: Fluor Daniels. Completion: Late 1991.

## CHINA

**HONG KONG AND CHINA GAS CO. Hong Kong.** 1,400 cum/d, Expansion of British Gas gas process under construction. Contr: Babcock

**Shenzhen City, Guangdong.** $150 MM processing complex. Capacities will be 86,200 mt/y LPG, 70,000 mt/y polypropylene, 100,000 mt/y gasoline.

**Zhongyuan field.** 45 MMscfd turboexpander associated gas plant. 50,000 mt/y ethane, 48,000 mt/y propane, 42,000 mt/y gasoline, 30 MMscfd dry gas. Lump sum contract: Linde.

## EGYPT

**AGIP S.p.A. El Qar'a.** 500 mt/d gas gathering and conditioning plant under construction. Design: Snamprogetti. Completion: 1991.

*300 mt/d ethane, LPG, gasoline recovery under construction. Design: Snamprogetti. Completion: 1991.

**BADR PETROLEUM. Western Desert.** Gas/Oil separation in the engineering stage. Engr: Bechtel. Completion: 1991.

**EGYPTIAN GENERAL PETROLEUM CO. Ameriya.** 250 MMcfd plant in engineering stage. 112,354 g/d LPG, 41,580 g/d condensate, 19 MMcfd $C_2/C_3$ mix. Completion: Mar. 1992.

**OPERATING PETROLEUM CO. Abu Qir gas field.** 330 MMcfd onshore plant. Contr: Technip Geoproduction.

## FRANCE

**ARCO CHEMICAL EUROPE. Fos-sur-mer.** 140% expansion. Polyols, deisobutanizer debottlenecking and TBA/MTBE debottlenecking in the engeering stage. Contr: Foster Wheeler Francaise. Completion: 1990.

## GERMANY

**VE AUBENHANDELS INDUSTRIEANLAGEN IMPORTS. VEB Leunawerke.** Expansion of gas circulation compressor and synthese gas compressor. $14 million. Engr: Mannesman Anlagenbau. Completion: Dec. 1991.

**RWE-DEA. Infenham.** Revamp of gas storage unit under construction. Contr: Edeleanu. Completion: 1990.

## INDIA

**IBP CO. LTD. Gujarat, Assam.** 122,410 mt/y of LPG and other products will be produced at three plants, Gandhar and Badoda, Both in Gujarat and Lakwa, Assam.

**GAS AUTHORITY OF INDIA LTD. Auraiya, Uttar Pradesh.** $1.38 billion separation plant. Planned.

**Guna, Madhya Pradesh.** $490 MM gas processing plant. Planned.

**MADRAS REFINERIES LTD. Thanjavur district.** 10,000 b/d gas processing plant to handle crude and associated gas from Cauvery basin fields.

**OIL & NATURAL GAS COMMISSION. Gandhar and Mehsana, Gujarat; Lakwa, Assam; offshore Krishna-Godavari basin; Agartala basin, Tripura.** Five gas processing plants. 500,000 mt/y LPG.

## INDONESIA

***ATLANTIC RICHFIELD BALI NORTH INC. Jakarta.** 350 MMscfd gas processing plant in the engineering stage. Completion: Oct. 1992.

***ATLANTIC RICHFIELD INDONESIA, INC. Jakarta.** 114 MMscfd bravo 2 compression & $CO_2$ removal in the engineering stage. Completion: 1st Qtr. 1994.

***ARCO INTERNATIONAL. Pagerungan Island.** 176 MMscfd gas plant in the engineering stage. Engr: Ralph Parsons. Completion: 1991.

**EXXON PRODUCTION. Natuna Is.** LNG plant in the engineering stage. Engr: Bechtel. Completion: 1993.

**PERTAMINA. Bontang, East Kalimantan.** Badak III. 1.5 MM mt/y LNG train. Completion: 1990.

**TOTAL INDONESIE. Tambora-Tunu fields, East Kalimantan.** 250 MMcfd plant under construction. 400,000 g/d raw NGL mix. Absorption-glycol method. Completion: 1990.

## ITALY

**SNAM SpA. Panigaglia.** 11 MM cum/d LNG expansion under construction. Contractor: Snamprogetti. Engr: Snamprogetti. Completion: 1991.

## LIBYA

**MOBIL OIL.** 15,000 b/sd oil separation plant in engineering stage. Contr: FW Italiana.

**OCCIDENTAL. Hakim.** 24,000 b/sd oil separation plant in engineering stage. Contr: FW Italiana.

**SIRTE OIL.** 40,000 b/sd oil, 155 MMcfd gas separation-treating plant in engineering stage. Contr: FW Italiana.

## MALAYSIA

**PETRONAS. Kerteh, Terengganu.** 250 MMscfd expansion.

32 MMscfd ethane, 566,000 mt/d propane, 360,000 mt/d butane, 378,000 mt/d pentanes plus. Eng: TEC. Cryogenic expander method. Completion: Sept. 1991.

Two 250 MMscfd gas processing plants (GPP-2 & GPP-3) in the engineering stage. Consortium leader: Stone & Webster. Completion: 1992.

**Bintulu.** 100 MMcfd gas processing plant. $750 MM. (joint venture with Royal Dutch/Shell). Planning. Yield 12,000 b/d.

## MEXICO

**PETROLEOS MEXICANOS. *Mataplonche, Ver.** 150 MMcfd cryogenic expander under construction. Completion: 1992.

## THE NETHERLANDS

**AMOCO NETHERLANDS PETROLEUM CO. Offshore.** 400 MMcfd gas production facility. Engr: Brown & Root. Completion: 1992.

**NAM. Dalen.** 1.25 MM mt/d natural gas treatment plant in the engineering stage. Design: Comprimo. Completion: 1990.

**NOGAT BV. Den Helder.** Gas treatment plant in the engineering stage. Contr: Comprimo BV. (joint venture of NAM, Petroland Group and Energie Beheer Nederland.) Completion: 1991.

## NEW ZEALAND

**SHELL BP AND TODD OIL SERVICES LTD. Maui, Taranaki.** $C_6+$ expansion. Products: 43,804 g/d LP mix, 21,400 g/d condensate. Completion: Jan. 1993.

## NIGERIA

**NIGERIA LNG LTD. Benny Island.** 4 MM tons LNG. Completion: Early 1995.

## OMAN

**AL FURAT PETROLEUM CO. Omar field.** 130 MMcfd gas plant. Completion: Mid 1991. (joint venture of Syria Shell, Shell Pecten, Deminex and Syrian Petroleum Co.)

## PAKISTAN

**OIL & GAS DEVELOPMENT CORP. Lashari field.** 30 MMscfd gas dehydration unit. TEG process.

**Pirkoh field.** 100 MMscfd gas dehydration unit. TEG process.

## PAPUA NEW GUINEA

**CHEVRON OIL. Kutubu field.** Gas/Oil separator in the engineering stage. Engr: Bechtel. Completion: 1993.

**PHILLIPS PETROLEUM.** LNG plant in the engineering stage. Engr: Bechtel. Completion: 1992.

## PERU

**PETROLEOS DEL PERU. Aguaytia-Ucayali.** 30 MMcfd plant. 29,400 g/d LPG, 25,200 g/d gasoline, 33,600 g/d kerosine-diesel. Refrigeration only. $40 MM. Contr: Pemex/Condux/Bruce/Upaca. Completion: 1990.

**Camisea-Cuzco.** 1,000 MMcfd plant. 600,000 g/d LPG, 400,000 g/d gasoline, 700,000 g/d naphtha. $1,300. MM. Completion: 1993.

## QATAR

**NATIONAL OIL DISTRIBUTION. Umm-Said.** 10,000 b/d fractionation of heavy condensate (from North Gas field) in engineering stage.

**QATAR GENERAL PETROLEUM CORP. North Field development project. Arabian Gulf.** 2,400 MMscfd gas plant in the engineering stage. Phase I. Engr: Bechtel. Completion: 1991.

## SAUDI ARABIA

**ARAMCO SERVICES CO. Uthmaniyah.** 360 MMscfd expasion of gas/oil separation facilities, #4 and #13 in the engineering stage. Contr: Bechtel. Completion: 1991.

***ARAMCO SERVICES CO. Southern Area.** 300 MBPD gas/oil separation plant in the engineering stage. Engr/Contr: Parsons. Completion: 1994.

## SYRIA

**AL-FURAT PETROLEUM CO. Tayyim field, ne Syria.** (Syrian Petroleum 50%). 40 MMcfd associated gas treatment plant under construction. $30 MM. Contr: Propak Systems-Canada. Completion: 1991.

## SWEDEN

**NYNAS ENERGY & CHEMICA'S COMPLEX. Nynasnamn.** Texaco-gasification, gas treatment facilities in the engineering stage. Design: Uhde. Completion: 1993.

**SHELL RAFF. AB. Gothenburg.** 170 mt/d LPG, 70 mt/d pentanes+. Contr: Linde.

## SWITZERLAND

**RAFFINERIE DE CRESSIER. Neuchatel.** 25 mt/d SCOT in the engineering stage. Engr: Comprimo. Completion: 1990.

## THAILAND

**PETROLEUM AUTHORITY OF THAILAND.** (25% PTT, 75% Thai Shell Exploration-Production). **Sirikit field, Kamphaeng Phet.** 40 MMcfd plant. 35,000 mt/y LPG, 700 b/d condensate. Contr: Randall Process Systems (U.S.). Completion: 1990.

**Rayong.** 250 MMscfd gas processing/marine terminal in the engineering stage. Engr: Fish. Completion: 1990.

## TRINIDAD

**NATIONAL GAS CO. OF TRINIDAD & TOBAGO LTD. Port of Spain, Trinidad.** (joint venture with Conoco and Pan West) 650 MMscfd gas processing plant. $100 MM. Yield: 6,500 b/d propane, isobutane, 3,300 b/d normal butane, 3,200 b/d natural gasoline. Eng/Contr: Pan West. Completion: March 1991.

## UNITED KINGDOM

***AMOCO UK EXPLORATION CO. Offshore.** 600 MMscfd centralized gas dehydration platform. Planned.

**BRITISH GAS CO. Easington, Hemberside.** 330 MMscf/d expansion of gas receiving dew point methanol recovery condensate system under construction. Contr: Parsons. Completion: 1990.

**B.P. PETROLEUM DEVELOPMENT LTD. Dimundton, Humberside.** 450 MMscf/d expansion of gas receiving dew point condensate unit under construction. Contr: Parsons. Completion: 1990.

**SHELL-ESSO. Mossmoran, Scotland.** 1.3 million mt/y expansion. Contr: Costain Engineering Ltd. Completion: June 1992.

## U.S.S.R.

**MACHINOIMPORT. Tenguiz II.** Natural gas and oil treatment plant including 2 Claus plants under construction. Contr: Lurgi/Partec Lavalin. Completion: 1990

**Tenguiz III.** Natural gas and oil treatment plant including 2 Claus plants under construction. Contr: Lurgi/Partec Lavalin. Completion: Late 1991.

**SOVIET MINISTRY OF OIL REFINING AND PETROCHEMICAL INDUSTRY. Surgut and Tobolsk.** Gas processing plants. $10 billion. Feasibility study: Combustion Engineering, McDermott International, Mitsubishi, Mitsui. Completion: Late 1990's.

## VENEZUELA

***CORPOVEN, S.A. North Monagas Oil Field.** 5 MMscfd acid tail gas processing plant in the engineering stage. Engr: Parson. Completion: 1991.

***Jose.** 800 MMcfd gas processing complex in the engineering stage. Contr: Fluor Daniel. Completion: Early 1991.

**Anzoategui.** 400 MMcfd expansion for gas processing capacity.

# Related Fuels—WORLDWIDE CONSTRUCTION

*Designates projects listed for the first time in the Journal.

## UNITED STATES

**AMCOAL (MW Kellogg and Bechtel development). Quemahoning Indus. Park, Johnstown, Somerset County, Pa.** Coal gasification plant processing 485 t/d high sulfur coal. When completed the plant will generate 60 mg electricity. Completion: 1991.

***CHEVRON U.S.A. INC. Richmond, Ca.** 130,000 kw waste gas fueled cogeneration plant.

***EXXON CO. U.S.A. Benicia, Ca.** 49,000 kw cogeneration plant.

**MANITOWOC, WIS., PUBLIC UTILITIES.** 200,000 lb/hr bituminous coal and petroleum coke fired circulating fluidized bed steam generator. Contr: Foster Wheeler. $12 MM. Completion: March 1991.

**OHIO ONTARIO CLEAN FUELS INC. Warren, Ohio.** 12,280 b/d coal to liquid fuel (using catalytic process to liquefy crushed and ground coal). Design: HRI. Engr: Stone & Webster. $225 MM. Completion: 1995.

**OLD DOMINION ELECTRIC COOPERATIVE. Richmond, Va.** 393,000 kw pulverized coal fired power plant. Contr: Westinghouse/Combustion Engineering/H.B. Zachry/Black & Veatch. Completion: 1993.

**PACIFIC ENERGY. Mammoth Lakes, Calif.** 22 MW Geothermal power plant in the engineering stage. $50 million. Contr: Ben Holt Co. Completion: Dec. 1990.

**SALT CITY ENERGY VENTURE. Solvay, N.Y.** Conversion of a direct coal fired power plant. 80,000 kw of electricity and 40,000 lb/hr of process steam. Engr: Duke/Fluor Daniel. $78 MM.

**TENNESSEE EASTMAN. Kingsport.** Coal gasification expansion in engineering stage. Contr: Bechtel. Completion: 1991.

10 MMscfd acid gas removal & cryogenic separation expansion in the engineering stage. Process Design: Linde. Completion: 1991.

**TEXACO R&M. Anacortes, Wash.** (partnership with Mission Energy) 80 mw Cogeneration plant. Completion: Nov. 1991.

## BRAZIL

**PETROBRÁS. SÁO MATEUS DO SUL, PR.** 2,500 b/cd shale oil extraction. Petrosix process. Contr: Staff. Completion: 1990.

## CANADA

**BP CANADA & PETRO-CANADA. Wolf Lake, Alta.** 15,000 b/d bitumen expansion from tar sands. Completion: 1990-91.

**ESSO RESOURCES CANADA LTD. (OSLO project). Fort McMurray, Alta.** (Consortium members: Esso (25%); Canadian Occidental Petroleum Ltd. (20%); Gulf Canada Resources Ltd. (20%); Petro-Canada (15%); PanCanadian Petroleum Ltd. (10%); and Alberta Oil Sands Equity (10%). 77,000 b/d from oil sands. Basic engineering and site preparation studies proceeding. $3.5 billion. Construction to begin in 1991. Completion: 1996.

**HUSKY OIL OPERATIONS LTD. Lloydminster, Sask.** 46,000 b/d heavy oil upgrader under construction. $1.2 billion. Hydrocracker (HRI); delayed coker and hydrogen plant (FW/SNC); primary upgrader plant (PCL/Braun/Simons); sulfur recovery (Monenco); crude plant and secondary upgrader (Bantrel). Completion: 1992.

**SUNCOR. Fort McMurray.** 75,000 b/d expansion (125,000 b/d total cap.) from oil sands. $2 billion. Seeking investors.

18,000 b/d crude expansion from oil sands (71,000 b/d total capacity). $50 MM. Completion: 1991.

## CHINA

**SHOUGANG. Beijing.** 1,000 mt/d coal gasification plant in engineering stage. Contr: CTIP. Completion: 1991.

## IRAQ

**Khor al-Zubair.** Fertilizer complex including two 1,000 metric mt/d ammonia trains and two 1,750 mt/d urea trains. $350 MM. Contr: Snamprogetti Spa.

## THE NETHERLANDS

**DEMKOLEC. Buggenum.** 250 mw power-from-Coal-gas demo project in the engineering stage. Design: Comprimo. Completion: 1993.

**GE PLASTICS. Bergen op Zoom.** 40 mw cogeneration plant under construction. Contr: Comprimo. Completion: 1990.

## TANZANIA.

**TANZANIA PETROLEUM DEVELOPMENT CORP. Dar-Es-Salaam.** 30,000 mt/y bitumen plant under construction. Contr: Snamprogetti. Completion: 1990.

## United Kingdom

**BRITISH GAS PLC. Westfield, Scotland.** New Coal Briquetting plant under construction. Contr: Babcock.

**BRITISH COAL. Point of Ayr, North Wales.** 2.5 mt/d coal liquefaction pilot plant under construction. Contr: Simon-Carves. Completion: 1990.

## U.S.S.R.

**V/O TECHMASHIMPORT. Belovo.** 3 million mt/y high concentration coal slurry reocarb under construction. Contr: Snamprogetti. Completion: 1990.

## ZAMBIA

**NITROGEN CHEMICALS OF ZAMBIA. Kafue.** 300 mt/y revamp. Coal gasification for ammonia, under construction. Contr: Krupp Koppers/Klockner. Completion: 1991

# Pipelining—WORLDWIDE CONSTRUCTION

*Designates projects listed for the first time in the Journal.

## U.S. CRUDE LINES

**ALL AMERICAN PIPELINE.** 525 miles, 30 in. from McCamey to Webster, Tex. Contr: RB Potashnick (301 miles). Completion: 1990.

**AMOCO PIPELINE CO.** 19 miles, 8 in. trunk line replacement in Oklahoma.

8 miles, 8 in. trunk line replacement in North Dakota.

5 miles, 4 in. and 5 miles, 8 in. gathering line replacement in Texas.

3 miles, 8 in., 10 miles, 12 in. and 1.5 miles, 26 in. trunk line replacements in Texas.

**ARCO ALASKA INC.** 6 miles, 60 in. loop of existing gas gathering for Prudhoe Bay field (EOA). Design: C.F. Braun Inc. Completion: 1990.

***CELREON CORP.** 11 miles, 24 in. line from Gaviota, CA. to Las-Flores, CA. under construction.

**PERMIAN OPERATING LTD. PARTNERSHIP.** 13 miles, 6 in. from Dolphin field, Divide County, N.D., southeast to an Amoco pipeline in Burke County, N.D.

**SOUTHERN CALIFORNIA PIPELINE SYSTEM.** (Chevron Pipeline project manager, Four Corners Pipeline, Shell, Texaco).

Los Padres Pipeline: 124 miles, 30 in. from Gaviota, Santa Barbara County, Calif., to Emidio, Kern County, Calif. $350 MM. Proposed.

Angeles Pipeline: 130 miles, 30 in. from Emidio, Kern County, Calif., to Los Angeles basin refineries. $250 MM. Planned. Completion: mid 1992.

***SUN REFINING & MARKETING.** 8.4 miles, 2-3 in. line from various lease connections - Oklahoma gathering system. Contr: Mid-Continent Pipe Line Co.

**WEST TEXAS PIPELINE.** Conoco Pipe Line Co. will construct the 180 mile, 6 in. line from its Southlake terminal near Dallas to Abilene, Tex. Completion: Late 1990.

## U.S. PRODUCT LINES

**AMOCO PIPELINE CO.** 2 miles, 18 in. trunk line replacement in Texas.

20.6 miles, 12 in. trunk line replacement in Missouri.

**ARCO PIPE LINE CO.** 52.5 miles petrochemical line from Channelview, TX. to Deer Park, TX. in the design phase. Completion: Dec. 1990.

***CENEX.** 246 miles, 8 in. line from Minot, N.D. to Fargo, N.D. to connect with the Williams pipe line system. Completion: Spring 1992.

**COLONIAL PIPELINE CO.** 45 miles, 12 in. line from Bainbridge, Ga. to Lloyd, Fl. Completion: Spring 1991.

**EXPLORER PIPELINE.** 28 in. mainline expansion from Gulf Coast to Dallas-Fort Worth area under study.

## U.S. GAS LINES

**ARKLA ENERGY RESOURCES.** 8.1 miles, 4 in. and up line in various locations within Kan., Okla., La., Ark., and Tex. (rehabilitate, lower or replace transmission & gathering lines). Completion: Dec. 1990.

**AMERICAN PIPELINE.** 38 miles, 16 in. in East Texas to connect Union Pacific Resources Carthage gas processing plant with pipelines to the West.

**AMOCO PIPELINE CO.** upgrading a 16 in. line from Drumright, Okla. to Okla-Texas line. Contr: Cimarron Pipeline Const. Inc. Completion: 1990.

**ANR PIPELINE.** 94 miles, 30 in. loop of existing lines. (southwest mainline expansion) Planned.

**CHAMPLAIN PIPELINE CO.** 253 mile line from Highgate, Vt., to Medway, Mass. $354 MM. Planned.

***CMS GAS TRANSMISSIN CO.** 25 miles, $6.5 million gas pipeline in Otsego, Crawford, and Kalkaska counties, Mich. Filed with Michigan Public Service Comm.

***CNG Transmission Corp.** 47 miles, 20 in. line from Kanawha Co., WV. to Wyoming Co., WV. Completion: 1992.

*7 miles, 24 in. line from Prince William Co., WV. to Fauquier Co., VA.. 1991.

**COASTAL CORP.** (joint venture with Arkla Inc.) 1000 miles, 30 in. Wyoming-California Pipeline Co. gas system. planned.

**COLORADO INTERSTATE GAS CO.** 13.4 miles, 2-6 in. Systemwide gathering (Colo., Kan, Okla., Tex, Utah, Wyo.). Planned. Completion: Dec. 1990.

**COLUMBIA GAS TRANSMISSION CORP.** 5.1 miles of 24 in. in Lancaster county, Pa. Before FERC. Completion: Nov. 1991.

7.2 miles of 24 in. in Fayette and Greene counties, Pa.

Planned. Completion: Nov. 1991.

*7.2 miles, 24 in. in Lancaster Co., Pa. Completion: Nov. 1991.

*14.2 miles, 24 in. in Albemarle, Louisa, Goochland & Chesterfield Cos., Va. Before FERC. Completion: Nov. 1991.

*5.8 miles, 36 in. in Hardy Co., WV. Before FERC. Completion: Aug. 1992.

*9.5 miles, 24 in. in Rockland Co., N.J., Completion: July 1991

**COLUMBIA GULF TRANSMISSION CO.** 20.3 miles, 16 in. line from West Cameron 485 to East Cameron 313. planning.

**CNG TRANSMISSION CORP.** 2[illegible] miles, 16 in. from Armstrong county to Clarion county, Pa. Completion: 1990.

19 miles, 18 in. from Doddridge county to Lewis county, W.Va. Completion: 1990.

12 miles, 20 in. Tompkins county, N.Y. Completion: 1990.

7 miles, 24 in. from Clay county to Calhoun county, W.Va. Completion: 1990.

25 miles, 30 in. from Butler county to Allegheny county, Pa. Completion: 1990.

**DELTA PIPELINE CO.** 190 miles, 24 in. from Wilburton in Latimer Co., Okla., eastward through Arkoma basin in Arkansas. $82 MM. Completion: June 1990. Before FERC.

**EASTERN AMERICAN STATES TRANSMISSION.** (Coastal Corp.). 285 miles, 30 in. from Ohio to Pennsylvania and 76 miles, 24 in. from New York to Long Island. Before FERC

**EL PASO NATURAL GAS.** 14.8 miles, 30 in. loop line from Mohave Companion Project to transmission loop in Arizona. $10.8 MM. Before FERC. Completion: Mid 1992.

26 miles, 30-34 in. from coal steam project to transmission loops in New Mexico. $23 MM. Before FERC. Completion: Mid 1991.

12.96 miles, 30 in. from Wenden to Ehrenberg to transmission loops in Arizonia. Before FERC. Completion: Mid 1991.

187.6 miles, 34 in. and 50.4 miles, 36 in. from OEC-Mojave project to transmission loops in Co., N.M. and Ariz. Before FERC. Completion: Mid-1992.

**EMPIRE STATE PIPELINE.** (Coastal Corp., Houston, and Union Enterprises Ltd., Toronto). 155 miles, from Niagara Falls to Syracuse to connect with Union Gas Ltd.'s Canadian system. $82.5 MM. Proposed. Completion: late 1990 or early 1991.

**ENDEVCO INC.** 240 miles, 20-24 in. from Shreveport, La. to south central Mississippi. (joint venture with Bass family interests of Fort Worth) $95 million. Completion: Winter 1991-92.

*44 miles, 24 in line from Delhi, La. to Vicksburg, Miss. Planned.

*19 miles, 12-8 in line in Smith and Simpson counties, Miss.

**ENRON CORP.** 191.2 miles, 4-20 in. from Louisiana to South Florida. Pending FERC.

30 miles, 24 in. north of Janesville, Wis. to sw corner of Waukesha County. Pending Wisconsin PUC.

Filed with FERC for an expansion of it's eastern leg from Ogden, Iowa to near Janesville, Wis. Expected completion: 1990-92.

**FLORIDA GAS TRANSMISSION.** 23 miles, 8 in. from Salt Springs, Fl. to Ocala, Fl. FERC approved. Completion: Dec. 1990.

**GATEWAY PIPELINE CO.** (United Gas Pipe Line). 25 miles, 30 in. line to connect existing and planned gas treatment plants in Mobile County, Ala., to United's Lirette, La., to Mobile, Ala., line. Before FERC.

***INTERCON GAS INC.** 77 miles, 6 in. line from near Festus, Mo. to Rolla, Mo. Completion: Late 1991.

**IROQUOIS GAS TRANSMISSION SYSTEM.** 250 miles, 30 in. from Iroquois, Ont., to Wright, N.Y., and 120 miles, 24 in. from Wright to South Commack, N.Y. (Long Island) $524.7 MM. Completion: 1990.

**JUBILLE PIPELINE SYSTEM.** 100 miles, 8-24 in. Various offshore blocks in Mobil area Bayou La Batre. Planned. Completion: 1991.

**KERN RIVER GAS TRANSMISSION.** (Williams Cos. and Tenneco). 762 miles, 36 in. from Kemmerer, Wyo. to Bakersfield, Calif. $800 MM. FERC final certificate issued.

**MAGNOLIA PIPELINE CO.** (Basin Pipeline Corp. and a unit of Transco Energy Co.) 55 miles intrastate line, 40 miles of laterals from Alabama's Black Warrior basin to Transco's interstate line in Central Alabama. $55 Million.

**MARATHON OIL CO.** 16 miles, 16 in line from Granite point in south central Alaska to Beluga, Alas. Contr: Seagull Gas Co.

**MEXUS INTERSTATE PIPELINE INC.** (Intercon Gas Inc.) 1,625 miles along the U.S.-Mexico border from Reynosa, Tamaulipas, to Tijuana, Baja Calif. 30 miles, 30 in. laterals to U.S. border.

**MICHIGAN CONSOLIDATED GAS.** 25.2 miles, 10¾ in. and 6.8 miles, 6⅝ in. mainline extension from Forest township, Cheboygan County to Pulawski township, Presque Isle County, Mich.

***MID-CON CORP.**107 miles, 24 in from Latimer Co., OK. to Bryan Co., OK. Planned. Completion: January 1991.

**MISSOURI PIPELINE CO.** 22 miles of 12-16 in. line from Curryville, Mo. to St. Charles and West Alton, Mo. $15 MM.

Converting 70 miles of existing crude line to gas line in Pike, Lincoln, and St. Charles counties, Mo.

**MOJAVE PIPELINE.** (Enron Corp. and El Paso Natural Gas). 383 miles, from San Ardo, Calif. to Needles station near Topock, Ariz. (Lateral to Kern County, Calif.). $250 M.M. Proposed.

**NORTHERN BORDER PIPELINE.** 368 miles, 30 in. mainline extension from Ventura, Iowa, to Chrisman, Ill. Before FERC. $374 MM. Completion: Nov. 1991.

**NORTHERN NATURAL GAS.** 13 miles, 16 in. from Matagorda Block 686 to Matagorda Block 624. Planned. July 1990.

*88 miles, 20 in. from Roger Mills Co., Okla. to Roberts Co., Tex. Planned. 1991.

**NORTHWEST PIPELINE CORP.** 33 miles, 30 in. line from Ignacio gas processing plant at Durango, Colo. to Blanco. Completion: Dec. 1991.

**PACIFIC GAS TRANSMISSION.** 430 miles, 42 in. from Kingsgate, B.C., to Malin, Ore. $945 MM. Before FERC. Project manager: Bechtel. Completion: 1993.

294 miles, 42 in. and 120 miles, 36 in. from Malin, Ore. to Kern River Station, Calif. Before CPUC. Project manager: Bechtel. Completion: 1993.

***PHILLIPS PIPELINE CO.** 324 miles, 10 in. from Midland, TX. to Sweeney, Tx. Design: Gulf Interstate. Copmpletion: Late 1991.

**SAGINAW BAY PIPELINE.** (Michigan Consolidated Gas) 125 miles, 10-20 in. from Ogemaw County, Mich., to Tuscola County, Mich. $65 MM. Completion: 1990.

**SEAGULL ENERGY CORP.** 42 miles, 24 in. from Oyster Lake Station to Old Ocean, Tex. Pending.

73 miles, four pipelines from Deer Park, Tex. to Mont Belvieu, Tex.

**SOUTHERN CALIFORNIA GAS CO.** 24.4 miles, 36 in. planned from Blythe station to 24.4 miles westerly. Completion: Dec. 1990.

19 miles, 36 in. planned from Moreno station to Chino. Completion: Dec. 1990.

***SOUTHERN NATURAL GAS CO.** 81.3 miles, 20 in. from Winn parish, LA to Concordia parish, LA. Planning. Completion: Oct. 1991.

*55.1 miles, 24 in. and 36 in. Mobil Bay Pipeline. (Mobil Co., AL) FERC filing. Completion: Dec. 1991.

**TENNECO INC. AND CITRUS CORP.** (joint venture) 53 miles, 36 in. line from Mobile Bay off Alabama north to an interconnection with Florida Gas Transmission Co. Before FERC.

**TENNESSEE GAS PIPELINE.** 48.7 miles, 30 in. line between the Niagara River at Lewiston, N.Y., and East Aurora, N.Y. Completion: Nov. 1990.

67.1 miles of loop and laterals on Tennessee's existing system. $100 MM. Completion: 1990.

**TENNESSEE RIVER INTRASTATE CO.** (with Champion International Corp.) 38 mile line to Courtland, Ala.

**TEXAS EASTERN TRANSMISSION** (joint venture with ANR Pipeline) 204 miles, 30 in. line from existing and proposed gas processing plants in Mobile County, Ala., northwest to Texas Eastern's main line in Kosciusko, Miss. $153.3 MM. Before FERC.

(Texas Eastern only) 55 mile, 24 in. offshore line from Mobile County, Ala. and future offshore production facilities in the Norphlet trend southwest to a proposed Viosca Knoll extension of the company's Main Pass pipeline system. $72.5 MM.

**TEXAS GAS TRANSMISSION CORP.** 15.3 miles, 20 in. line in Breckinridge co., Ky. Completion: 1990.

62.4 miles, 36 in. line from Daviess co., Ky. to Warren co., Oh. Completion: 1991.

69 miles, 30 in. from Bolivar co., Miss. to Lincoln co., Ark. Completion: 1991.

*26.4 miles, 36 in. line from Ohio Co., Ky. to Dearborn Co., In. Completion: 1992.

*21.1 miles, 24 in. line in Claiborne Parish, La. Completion: 1991.

*5.7 miles, 30 in. line from Hopkins Co., Ky. to Muhlenberg Co., Ky. Planned. Completion: 1991.

*5.4 miles, 20 in. line in Muhlenberg Co., Ky. Planned. Completion: 1991.

**TRANSCONTINENTAL GAS PIPELINE CO.** 23.94 miles, 36 in. loops in Monroe and Luzerne counties, Pa. Contr: Murphy Bros.

48 miles, 12-30 in. from Edison to Riverdale, N.J.. Contr: Napp-Grecco Corp.

5 miles, 36 in. in Morris and Essex counties, N.J. Contr: Otis Eastern Services Inc.

**VIRGINIA NATURAL GAS.** 80 miles, 24 in. and 40 miles, 10 in. from Richmond, Va. to James

City County, Va. Completion: 1991.

**WYCAL-Wyoming-California Pipeline Co.** (Coastal Corp.). 1,000 miles, 30 in. from Rocky Mountain Overthrust Belt, sw Wyoming to near Bakersfield, Calif. FERC final certificate issued. $665 MM. Completion: Late 1991.

**YUKON PACIFIC CORP.** 820 miles from Prudhoe Bay to Kenai Peninsula. Proposed.

## ABU DHABI

**ABU DHABI NATIONAL OIL.** 93 miles, 28 in. Maqta-Al-Ain gas line. Completion: Dec. 1990.

## AFRICA

**KENYA PIPELINE CO.** Extention of Kenya's main oil products pipeline from Nairobi to western parts of the country.

## ALGERIA

300 mile gas line from Hassi R'Mel gas field in Algeria to the Moroccan border. Proposed. Completion: 1995.

## AUSTRALIA

**GAS & FUEL CORP.** 5 miles, 6 in. natural gas line from Kyabram to Tongala planned. Completion: July 1991.

**QUEENSLAND GOVERNMENT.** 330 miles, 12.2 in. gas line to connect Surat basin and Denison Trough gas fields, southeast Queensland. Bids out. $100 MM.

## AUSTRIA

**OEMV AKTIENGESELLSCHAFT.** 194 miles, 42 in. gas line in progess. Austrian section of U.S.S.R.-Italy Natural Gas Pipeline expansion. Contr: Snamprogetti. Completion: 1991.

## BANGLADESH

**BANGLADESH OIL, GAS, AND MINERALS CORP.** 117 miles, 20 in. gas line from Kailashtila to Ashanganj. Design stage. Consulting: Pencol. Completion: 1991.

***TITAS GAS.** 78 miles, 24 in. and 61 miles, 12 in. line from a gas field near Ashunganj to a fertilizer plant near Tarakandi. Contr: Spie Capag. Completion: June 1991.

## BELGIUM

**DISTRIGAZ.** 22 miles, 24 in. gas line from De Lo to Ronquieres. Completion: Dec. 1990.

91 mile gas line of undetermined width from Zeebrugge to Blaregnies. Completion: 1992-1993.

## BOLIVIA

**YPFB.** 346 miles gas line from Santa Cruz to the Brazilian border. Planned.

## CANADA

**POUCE COUPE PIPE LINE LTD.** 16 miles of crude line connecting facilities built by Norcen Energy and Canadian Hunter in Northeast B.C. with Peace Pipe system in nw Alberta.

**ALTAMONT PROJECT.** (Amoco Canada Ltd., Canadian Occidental Petroleum Ltd., Esso Resources Canada Ltd., Home Oil Ltd., Mobil Oil Canada Ltd, Petro-Canada, and Shell Canada Ltd.) $1 billion gas line from Alberta to California. Proposed.

**FOOTHILLS PIPELINES (YUKON) LTD.** 1,429 miles of gas line from the Arctic Coast near Inuvik, N.W.T., to Caroline in Central Alberta to connect with existing North American pipeline systems. $4.4 billion. Before NEB. Completion: 1996.

**NOVA CORP. OF ALBERTA.** 18 miles of 24 in. and 10 miles of 20 in. laterals in the Grande Prairie/Beaver lodge area of Alberta.

870 miles, 4-42 in. gas line in Alberta. Completion: 1990.

**PACIFIC COAST ENERGY CORP.** (joint venture of Westcoast Energy and Chieftain Development) 330 miles, 10 in. line from British Columbia to Vancouver Island. $506 MM. Contr: Intec Engin. Inc. Completion: May 1991.

118 miles, 10¾ in. Mainland portion of the Vancouver Island pipeline project. Contr: Majestic Contr. Ltd.

*186 miles, 4-10 in. gas line from Victoria, B.C. to Campbell river, B.C.. Contr: Banister Pipeline. Completion: Sept. 1991.

**PACIFIC GAS TRANSMISSION CO.** 724 miles, 42 in. gas line from the British Columbia-Idaho border to San Fransico Bay area. Completion: 1993.

120 miles, 36 in. gas line from the San Fransico Bay area to Fresno county. Completion: 1993.

**PETROLEUM RESOURCES LTD.** 21 miles, sour gas pipeline near Calgary. $14 million. Approval received.

**POLAR GAS LIMITED.** 1,450 miles, 36 in. from Canadian Mackenzie Delta Pipeline Project to Caroline, Alta. Filed with NEB. Contr: Transcanada Pipelines Ltd., Tenneco Inc. and Panarctic Oils Ltd. Completion: Nov. 1996.

**SABLE GAS SYSTEMS** (TransCanada Pipelines, Nova Scotia Resources). 490 miles, 26 in. from Sable Island through Nova Scotia and New Brunswick to Maine border. Proposed.

**TRANSCANADA PIPELINES LTD.** 251 miles, 48 in. gas line, Saskatchewan and Manitoba looping. Before NEB. Completion: Nov. 1991.

479 miles, 42 in. gas line, Manitoba and Northern Ontario looping. Before NEB. Completion: March 1991 to Feb. 1992.

77 miles, 42 in. gas line from North bay to Ottawa looping. Before NEB. Completion: Oct. 1991.

8 miles, 36 in. gas line, Eastern Ontario looping. Before NEB. Completion: Oct. 1991.

61 miles, 48 in. gas line, Saskatchewan and Manitoba looping. Before NEB. Completion: Oct. 1992.

13 miles, 42 in. gas line, Northern Ontario looping. Before NEB. Completion: Oct. 1992.

37 miles, 42 in. gas line from North bay to Ottawa looping. Before NEB. Completion: Oct. 1992.

*9 miles, 36 in. gas line, Dawn extension looping. Conmpletion: Oct. 1991.

*12 miles, 24 in. gas line, Blackhorse extension before NEB. Completion: Oct. 1991.

*16 miles, 16 in. gas line, Gananoque extension before NEB. Completion: 1991.

*12 miles, 20 in. gas line, Quebec looping. Completion: Oct. 1991.

*22 miles, 12 in. gas line, Napierville extension, Quebec. Completion: April 1991.

***TRANS MOUTAIN OIL PIPE LINE CORP.** 144 miles, 36 in. crude line from low point, Wa. to anacortes & ferndale, Wa. Proposed. Completion: Late 1993.

*105 miles, 24 in. crude line from burlington, Wa. to low point, Wa. Proposed. Completion: Late 1993.

***UNION GAS.**

*10.2 km, 48 in. line in south western ontario. Completion: 1990.

*6.3 km, 10 in. line in south western cntario. Completion: 1990.

*65.1 km, 48 in. line in south western ontario. Completion: 1991.

*7.3 km, 26 in. line in south western ontario. Completion: 1991.

*33.4 km, 16 in. line in soutn western ontario. Completion: 1991.

*8.5 km, 12 in. line in south western ontario. Completion: 1991.

*11.8 km, 12 in. line in south western ontario. Completion: 1991.

## CHILE

**SOCIEDAD NACIONAL de OLEODUCTOS LTD.** 11 miles, 4 in. jet fuel line from Maipú, Chile to Pudahuel, Chile. Under study.

## CHINA

**CHINA NATIONAL OIL CORP.** 180 mile, 426 mm crude line from Zhongyuan oil field to Luoyang, Henan, refinery.

620 miles, 24 in. gas line from Yacheng field, Hainan Island to Guangdon Province, Guangzhou, south to Hong Kong. Feasibility study: Fluor Daniel PRC Ltd.

Qiong Zhou Strait crossing (Yacheng, Hainan, Hong Kong gas line). Joint study by: China National Offshore Oil Corp. and J.P. Kenny, London.

155 mile crude line from Shengli field to Huangdao, Shandong province. Eng-construction: Novacorp International.

230 mile gas line from Zhongyaun, Henan Province to Cangzhou, Hebei Province. Contr: Novacorp International.

## CHINA, TAIWAN

**CHINESE PETROLEUM CORP.**

GAS LINES:

170 miles, 26 in. gas line from Kang-shan valve station to Hsinchu governor station under construction. Contr: BES. Completion: Dec. 1990.

## COLOMBIA

**ECOPETROL.**

CRUDE LINES PLANNED:

290 miles, 24 in. from Vasconia to Covenas (Oleoducto Colombia). Completion: 1991.

37 miles, 10 in. from El Toldado to Gualanday. Completion: Dec. 1990.

9.5 miles, 20 in. from Galan to Vizcaina. Completion: Dec. 1990.

PRODUCTS LINES PLANNED:

18 miles, 6 in. from Medellin to Rionegro.

81 miles, 6 in. from Facatativa to Villavicencio.

20 miles, 12 in. from Sebastopol to Medellin.

47 miles, 6 in. from Neiva to Natagaima. Completion: June 1990.

8 miles, 8 in. from Tulua to Tulua. Completion: Dec. 1990.

11 miles, 12 in. from Girardota to Bello. Completion: June 1990.

82 miles, 14 in. from Pozos Colorados to Ayacucho. Completion: Dec. 1990.

17 miles, 8 in. from Guacari to Yumbo.

GAS LINE PLANNED:

58 miles, 20 in. from Dibulla to Ballenas.

**PROMIGAS S.A.** 373 miles, 20 in. and 2,459 miles, 24 in. gas line from Pajaro to Bogota under study.

7 miles, 4 in. gas line from Main Gas Pipe Line to Montelibano planned.

9.3 miles, 3 in, gas line from Main Gas Pipe Line to Corozal planned.

12.4 miles, 4 in. gas line from Main Gas Pipe Line to Arjona planned.

8.7 miles, 4 in. gas line from Barranquilla to Puerto Colombia planned.

5.4 miles, 3 in. gas line from Main Gas Pipe Line to Galapa planned.

## CUBA

116 mile crude line linking the terminal at Matanzas on the northern coast east of Havana with a refinery at Cienfuegos on the southern coast (with Soviet assistance.)

## DENMARK

**DANSK OLIE OG NATURGAS.** 7 miles, 12 in. gas line from Lynge to Hillerod. Under study. Completion: 1991.

14 miles, 12 in. gas line from Skjddelev to Aihus. Under study.

5 miles, 12 in. gas line from Kalvebod to HCV power plant. Under study.

5 miles, 10 in. gas line to power plant in Aalborg. Under study.

## ECUADOR

**PETROLEOS DEL ECUADOR.** 165 km., 6-8 in. gas line from La Libertad refinery to Manta, Ecuador. Contr: Techint.

## FINLAND

**NESTE OY.** 26 mile extension of Nesty Oy's southern Finland gas line into greater Helsinki. Contr: E. M. Pekkinen Oy. Welding and fitting: Zarubezhjneftegasstroi (U.S.S.R.). $10 MM.

## FRANCE

**ATOCHEM.** 19 miles, 4 in. product line in Gonfreville, France under construction. Completion: End 1990.

**GAZ DE FRANCE.** (joint venture with Gas du Sudouest and Enagas) 44 miles, 24 in. gas line from Serrablo, Spain to Lacq, France. Completion: 1991.

**STE. DU PIPELINE MEDITERANEE-RHONE.** 94 miles, 12¾ in. products line from La Mede (Bouches-du-Rhone) to Puget-sur-Ar-gens (Var). Eng. study: OTP.

## GERMANY, WEST

**MIDAS GmbH.** (joint venture of Wintershall AG and OMV AG) 348 miles, 32 in. gas line from Rysum (near Emden) to Ludwigshafen. Completion: 1993.

***GASVERSORGUNG SUDDEUTSCHLAND GmbH.** 19 miles, 16 in. gas line from Pfullendorf to Nenzingen planned. Completion: Oct. 1993.

***GOVT. OF THE FED. REP. OF GERMANY.** 44 miles, 10 in. product line from lechfeld to leipheim under construction. Completion: End 1990.

***RUHRGAS AG.** 153 miles, 48 in. gas line from Werne to Schluchtern planned. Contr: Pipeline Engineering GmbH. Completion: 1994.

*40 miles, 40 in. gas line from Lauterbach to Vitzeroda planned. Contr: Pipeline Engineering GmbH. Completion: End 1992.

*106 miles, 32-40 in. gas line from Vitzeroda to Gera planned. Contr: Arge PKM/PLE. Completion: End 1992.

## HUNGARY

**HUNGARIAN OIL AND GAS TRUST.** 22 miles, 31 in. gas line from Pilisvörösvár to Dorog planned. Contr: Olajterv, Kóolajvezetek Épitó Vállalat. Completion: 1990.

29 miles, 6 in. product line from Komarom to Gyor under construction. Contr: Olajterv, Koolajvezetek Epito Vallalat. Completion: 1990.

## INDIA

$600 MM crude and gas lines from Bombay High field to Hazira. Proposed.

**OIL & NATURAL GAS COMMISSION.** 15 miles, 24 in. products line for Hazira export terminal, under construction. Contr: Land & Marine (Inida) Ltd. Completion: May 1991.

**OIL INDIA LTD.** (Indian Oil Corp.) 826 mile petroleum products line from Kandla, Gujarat, to Bhantinda, Punjab. $240 MM. Completion: 1992.

## IRAN

**IGAT 2.** 880 miles, 48-56 in. from Kangan gas field on the Persian Gulf to the Soviet Union. Contr: Saipem (will lay 20% of remaining pipeline).

**NATIONAL IRANIAN OIL CO.** 63 miles, 42 in. crude line from Gurreh to Taheri (Moharram project). Contr: Snamprogetti. Completion: 1991.

## IRAQ

**SCOP-STATE ORGANIZATION FOR OIL PROJECTS.** 595 miles, 56-48 in. crude line from Iraq to Saudi Arabia (IPSA II project). Contr: Snamprogetti. Completion: 1990.

## ITALY

**ENEL.** 10 miles, 16 in. products line from Brindisi Nord to Brindisi Sud in the engineering stage. Completion: Dec. 1990.

***ENICHEM ANIC SpA.** 140 miles, 8-10 in. products line from Montedison Petro. complex (Ferrara) to Enichem Petro. complex (Ravenna) in progress. Contr: Snamprogetti. Completion: 1991.

**SNAM SpA.** 144 miles, 42 in. gas line from Malborghetto to Camisaon Vicentno in progress. Italian section of the U.S.S.R.-Italy Natural Gas Pipeline Expansion. Contr: Snamprogetti. Completion: 1991.

## KENYA

**KENYA PIPELINES CO. LTD.** 355 miles, 6-8 in. products line from Nairobi to western Kenya (extension of existing Mombasa to Nairobi pipeline) in conceptual design stage. Consulting: Pencol. Completion: 1991.

## KOREA

68 miles, 20-24 in. gas line. Part of a $130 MM project for a gas feeder pipeline system to join a pipeline from LNG facilities at Pyeong Taek to Inchon.

**KOREA PETROLEUM DEVELOPMENT CORP.** 541 miles, refined products trunkline system from refineries at Yosu and Onsan to Seoul. Completion: 1992.

## LIBYA

416 miles, gas line from Al Brika to Khoms.

## MALAYSIA

**PETRONAS.** 485 miles, 36 in. gas line from Kerteh on Malaysia's northeast coast to Singapore with branch lines to Kuala Lumpur and other large Malaysian cities. Total cost: $310 MM. Completion: Nov. 1991.

375 miles, 24-36 in. crude line. Planned.

## MEXICO

**PEMEX.**

CRUDE LINES

39 miles, 16 in. from Imuris to Canonea. Contr: Spie Capag.

PRODUCTS LINES

37.3 miles, 24 in. from Venta de Carpio, Edo. de Mexico to Tulsa, Hgo. Under construction.

GAS LINES

·155 miles, 24 in. from Jaltipan, Ver. to Salina Cruz, Oax. Planned.

18.6 miles, 16 in. from Matapionche, Ver. to Angostura, Ver. Engineering stage.

12.4 miles, 14 in. from Angostura, Ver. to Tierra Blanca, Ver. Engineering stage.

26.7 miles, 20 in. from Matapionche, Ver. to Paso del Toro, Ver. Engineering stage.

236.2 miles, 48 in. from Veracruz, Ver. to Santa Ana, Hgo. Under construction.

## MOROCCO

900 miles of gas line through Morocco to Tangier to a link across the Strait of Gilbralter to Spain. Proposed. Completion: 1995.

***SOCIETE CHERIFIENNE DES PETROLES.** 115 miles, 14 in. crude line from Port of Mohammedia to Sidi Kacen Refinery, study in progress. Engr: OTP.

## THE NETHERLANDS

**NV NEDERLANDSE GASUNIE.** 12.5 miles, 36 in. gas line from Rysbergen to Nispen planned. Completion: Dec. 1990.

19 miles, 48 in. gas line from Balgzand to Oud. tocht. planned. Completion: Oct. 1991.

12.5 miles, 12 in. gas line from Waalwyk to Kedichem planned. Completion: Oct. 1991.

34.5 miles, 24 in. gas line from Ommelw to Witteveen. Completion: Oct. 1992.

**NAM.** 161 miles, from F3 area of the Dutch North Sea to the Dutch Coast. (joint venture with Elf Petroland and Energie Beheer Nederland). Contr: McDermott-ETPM. Completion: 1991-92.

## NIGERIA

**AGIP ENERGY & NATURAL RESOURCES and NNPC.** 12 in. line from Aghbara offshore field to Brass terminal, Rivers State.

**NIGERIAN NATIONAL PETROLEUM CORP.** 234 miles, 16 in. and 75 miles, 12 in. products lines from Port Harcourt, Enugu, Auchi to Benin City, Nigeria. Design stage. Completion: 1990.

55 km, 16 in. Mogas/Gas oil product pipeline from proposed Bonny crude oil terminal to Port Harcourt refinery. Completion: June 1993.

55 km, 16 in. high pour fuel oil pipeline from proposed Bonny crude oil terminal to Port Harcourt refinery. Completion: June 1993.

**SHELL PETROLEUM DEVELOPMENT.** 27 miles, 24 in. crude line from Nkpoku to Bomu. Planned. Completion: Dec. 1990.

8 miles, 12 in. gas line from Cawthorne I flowstation to Alakiri gas plant. Planned. Completion: Jan. 1991.

14 miles, 12 in. gas line from Alakiri to Bomu. Planned. Completion: Jan. 1991.

7 miles, 8 in. crude line from Belema flowstation to Nembe

Creek Cawthorne Channel trunkline. Planned. Completion: Dec. 1992.

43 miles, 20-24 in. crude line from Opukushi to Forcados terminal (Trans Ramos Pipeline). Planned. Completion: Dec. 1993.

6 miles, 8 in. crude line from Okpokonou flowstation to Southern Forcados Pipeline at Ogara Manifold. Planned. Completion: Dec. 1993.

6 miles, 8 in. crude line from Kanbo flowstation to Trans Ramos Pipeline at Kanbo Manifold. Planned. Completion: Dec. 1993.

## NORWAY

**STATOIL.** 25 miles, 36 in. gas line from Zeepipe Sleipner to Statpipe. Eng: Snamprogetti. Planned. Completion: 1993.

524 miles, 30-40 in. gas line from Zeepipe Sleipner, Norway to Zeebruge, Belgium. (Zeepipe Natural Gas Transportation System - Phase 1) Eng: Snamprogetti. Completion: late 1993.

80 miles, 36 in. gas line from Zeepipe Troll to Heimdal. Planned. Completion: 1996.

95 miles, 40 in. gas line from Zeepipe Troll to Sleipner. Planned. Completion: 1996.

150 miles, 20 in. gas pipeline from Sleipner to Karsto. Planned. Completion: 1993.

## PAKISTAN

**PARCO.** (Pak Arak Refinery Co. Ltd.) 537 miles, 16 in. product line from Lahore to Islamabad in the engineering stage. Completion: 1991.

**SUI SOUTHERN GAS CO. LTD.** 182 miles, 20 in. gas loops from Sui to Karachi. Contruction in progress. Completion: Dec. 1990.

## PAPUA NEW GUINEA

**CHEVRON NIUGINI PTY LTD.** 162 miles, 20 in. crude line from lagifu-Hedina field to export terminal seeking govt. approval. Completion: 1992.

## PERU

**PETROLEOS DEL PERU.** 364 miles, 26 in.; 300 miles, 10 in.; 64 miles, 8 in. gas lines from Camisea-Cuzco to Callao-Lima. Bidding. Completion: mid 1993.

## SAUDI ARABIA

**SAUDI ARAMCO.** 1,200 km, 56 in. crude line from Arabian Gulf to Yanbu (Red Sea) in the engineering stage. Contr: Mannesmann AG. Completion: End 1992.

## SINGAPORE

**SHELL EASTERN PETROLEUM.** 5 miles, twin 10 in. lines from Pulau Bukom island to distribution terminal on the mainland. One line will be a product line and the other sulfur line. Completion: Early 1991.

12 miles, 10 in. product line. Pandan products pipeline in the design phase. Contr: Bechtel. Completion: 1991.

## SPAIN

**CAMPSA.** 134 miles, 8-12 in. products line from Tarragona to Barcelona-Gerona in engineering stage. Contr: Heymo. Completion: 1990.

*90 miles, 10 in. products line from La Coruna to Vigo in the engineering stage. Contr: Tecnicas Reunidas S.A. Completion: 1992.

*60 miles, 10 in. products line from Cartagena to Alicante in the engineering stage. Contr: Tecnicas Reunidas S.A. Completion: 1992.

**CIA. ARRENDATARIA DEL MONOPOLIO DE PETROLEOS SA.** 69 miles, 8 in. products line from Valladolid to Salamanca.

500 miles, product line. $150 MM. Completion: late 1991.

159 miles, 10 in. product pipeline from Corunna to Vigo in northwest Spain. Completion: Mid 1991.

**EMPRESA NACIONAL DE GAS SA.** 145 miles, 26 in. gas line from Sevilla to Brazatortas in engineering stage. Contr: Heymo. Completion: 1991.

44 miles, 24 in. gas line from Serrablo, Spain to Lacq, France. (joint venture with Gas de France and Gas du Sudouest). Contr: Heymo. Completion: 1991.

## SWITZERLAND

**GVM GASVERBUND MITTELLAND AG.** 17 miles, 12 in. natural gas line planned. Contr: Helbling Engineering. Completion: End 1991.

*7.5 miles, 12 in. gas line from Arlesheim to Prattein in the engineering phase. Engr: Helbling and Jauslin & Stebler Engin. Completion: End 1992.

*5 miles, 8 in. gas line from Lenzbrug to Villmergen in the engineering phase. Engr: Balzari & Schudel Engin. Completion: End 1992.

***GVO GASVERBUND OSTSCHWEIZ AG.** *5.5 miles, 10 in. gas line from Gossau to Bischofszell planned. Completion: End 1991.

## TANZANIA

**TAZAMA PIPELINES LTD.** 54 km, 8-12 in. crude line. pipeline rehabilitation, Phase 2. Contr: Saipem. Completion: 1990.

## THAILAND

**PETROLEUM AUTHORITY OF THAILAND. (PTT).**

99 miles, 28-32 in. gas line from Erawan to Khanom district to Nakhon Si Thammarat Province. Feasibility study.

106 miles, 28-32 in. gas line from PTT's B structure gas field to Unocal Thailand Ltd's Erawan field. Feasibility Study.

8 miles, 16-28 in. laterial loop gas line from Station No. 6 to Bangpakong power plant. Completion: 1990.

300 miles, 16-24 in. gas line from Nam Phong Khonkan Province to Saraburi Province. Feasibility study. Completion: 1993.

18 miles, 8 in. gas spur line from Sri Racha to Laem Chabang in Chon Buri Province. $3.5 MM. Completion: 1990.

50 miles, 14-16 in. oil products line from eastern Bangkok north to Ayutthaya Province. Feasibility study.

437.5 miles, 18-22 in. gas line from Khonkaen Province to Chon Buri Province. Planned. Completion: 1993.

121 miles, 32 in. gas line from offshore Texas Pacific field, Gulf of Thailand to Erawan field, Gulf of Thailand. Planned. Completion: 1992.

## TURKEY

**BOTAS.** Extension of 496 mile gas line from Ankara to Izmir. Proposed.

## UNITED KINGDOM

***ARCO BRITISH LTD.** 41 miles, 24 in. and 5 miles, 16 in. gas line from Pickerill gas field (UK-southern north sea) to Theddlethorp (UK mainland) in the engineering stage. Completion: 1992.

**BRITISH GAS CORP.** 15.6 miles, 36 in. gas line from Easington to Paull. Planned. Completion: Aug. 1991.

16 miles, 36 in. gas line from Epping to Horndon. Under study. Completion: 1992.

**BP and TOTAL OIL MARINE.** 15 miles, 12 in. link of St. Fergus gas line to Forties system at Cruden Bay. Contr: Norwest Holst.

**BP EXPLORATION.** 36 in. pipeline to serve Forties field in the U.K. North Sea. Contractor: ETPM Services (U.K.) Ltd.

15 mile, 12 in. natural gas liquids pipeline linking Total Oil Marine plc's St. Fergus, Scotland, gas terminal to BP's Cruden Bay terminal.

**CATS-Central Area Transmission System.** (40% Gas Council Exploration Ltd., 30% Amoco UK Exploration, 18% Amerada Hess, 12% Texas Eastern North Sea Inc.). $1.8 billion central U.K. North Seas gathering system in detailed design study. Completion: 1993.

**ESSO PETROLEUM CO.** 31 miles, 12 in. product line into Birmingham International Airport, England. Completion: Oct. 1991.

**MOBIL NORTH SEA LTD.** 210 miles, 30 in. gas line from Beryl oil field in the U.K. North Sea to St. Fergus, Scotland. Contr: Brown & Root and Saipem.

**MOBIL.** 210 miles, 30 in. from Beryl oil and gas field to St. Fergus, Scotland. 1991.

**SHELL CHEVRON U.K. LTD.** 251 miles, 10 in. ethylene pipeline system linking the Stanlow and Carrington plants in northwestern England to Grangemouth in the design phase. $154 MM. Contr: Bechtel. Completion: Early 1992.

**SIMON STORAGE GROUP LTD.** (North Thames Pipeline) 12 miles, 10 in. products line in design stage. Consulting: Pencol. Completion: 1990.

## VENEZUELA

**CORPOVEN SA.** 373 mile products line from Puerto la Cruz refinery to Maturin, San Tome, Ciudad Bolivar, Puerto Ordaz, Puerto Ayacucho.

**MARAVEN SA.** Sumandes products line from San Lorenzo, Lake Maracaibo to El Vigia and Tachira (Andes). Planned. $213 MM. Completion: 1990.

## ZAMBIA

**TAZAMA PIPELINES LTD.** 1,070 miles, 8-12 in. from Dar-Es-Salaam, Tanzania to Ndola. Design complete. On hold. Completion: 1990.

30 miles, 12 in. and 15 miles, 8 in. replacement of crude pipeline from Dar-Es-Salaam, Tanzania to Ndola, Zambia. Completion: 1990.

1,068 miles, 8 in. and 480 miles, 12 in. of crude pipeline from Dar-Es-Salaam, Tanzania to Ndola, Zambia. Contr: Inhouse. Completion: 1992.

## ZIMBABWE

**LONRHO PLC.** 135 miles, 10 in. products line from Feruka to Harare (extension of Beira to Feruka pipeline). Study and conceptual design stage. Consulting: Pencol. Completion: 1991.

# PIPELINE ECONOMICS

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# U.S. gas pipelines improve operations, want to expand

**Warren R. True**
Pipeline/Gas Processing Editor

Operations for regulated U.S. interstate natural-gas pipeline companies showed increased efficiency last year as incomes leaped despite flat revenues.

Net incomes for these companies gained more than $900 million in 1989, while operating revenues declined a negligible 1.2%.

Common-carrier oil pipelines, on the other hand, continued to operate in the doldrums with incomes declining for the third straight year and revenues dropping for the sixth year in a row (Table 1).

These data along with others from annual reports filed with the U.S. Federal Energy Regulatory Commission (FERC; see company tables pp. 58-63) are tracked in this annual Oil & Gas Journal Pipeline Economics Report. The shift of interstate natural-gas pipelines from merchants of gas to transporters continued in 1989. Volumes of gas moved for others by these companies increased by more than 9% for major companies and by more than 15% for major and nonmajor companies combined.

Gas sold by these same companies, however, declined again last year: by almost 13% for majors and by more than 5% for all companies reporting.

For common-carrier oil pipelines, moving both crude oil and product, operations continued sluggishly with declines across the board for data tracked by Journal Pipeline Economics Reports.

On the construction front, U.S. projects proposed for the 12-month period ending June 30 (Table 2) would appear to have almost trebled the mileage proposed to the FERC for the previous 12-month period.

In fact, several large projects filed with the commission were resubmissions of projects filed earlier. These latter filings involved changes in routing, length, diameters, or compression.

Nevertheless, companies' interest in installing new or system-expansion mileage continued high during the 12-month period covered. That several projects were refilings only indicates continued confidence by those companies in the growth of natural-gas use, especially as a relatively clean-burning fuel in light of the public's growing environmental concerns.

### Incomes and mileage

Net incomes for regulated major interstate natural-gas pipeline companies improved significantly last year, up by almost 51% ($720.6 million). Operating revenues, on the other hand, were down by 3.1% (−$826 million).

Net incomes for combined major and nonmajor gas-pipeline companies jumped 58.6% ($921.6 million); operating revenues slowed by 1.2% (−$392.5 million) over 1988.

Operating revenues for major and nonmajor natural-gas transmission companies have been falling since 1983 until a slight uptick for 1988 (Fig. 1). Similarly, net incomes fell in 1983 and for 2 years beginning with 1986. Last year's large increase was the largest of the decade, eclipsing a big jump in 1985.

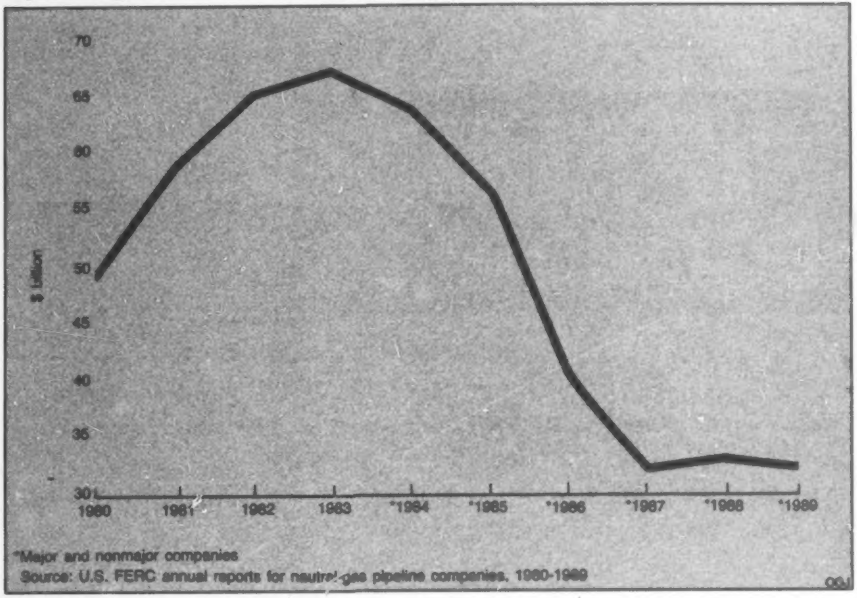
Petroleum liquids pipeline companies' net incomes in 1989 fell 11.11% (−$278.3 million) on operating revenues that declined 5.1% (−$350 million). That decline continues a trend begun in 1985. The decline in net incomes reverses three consecutive yearly rises.

Total pipeline mileage reported by major natural-gas companies fell almost 5% from 1988 to 1989. Mileage for field, transmission, and storage lines fell last year.

Despite a miniscule uptick in transmission mileage for combined major and nonmajor natural-gas companies, the pattern held for these companies: total mileage uti-

Fig. 1

## Operating revenues: natural-gas pipeline companies



*Major and nonmajor companies
Source: U.S. FERC annual reports for neutral-gas pipeline companies, 1980-1989

lized fell by almost 8,000 miles (−2.8%).

Liquid pipeline companies showed virtually no change (−1.07%) in total pipeline mileage utilized during 1989 compared with 1988. Mileage for gathering, crude oil, and product pipelines fell uniformly and slightly last year.

Total mileage reported for 1989 was 442,038 with 273,401 devoted to gas transmission, field, and storage, while 168,637 was for crude oil and product pipelines (Table 3).

### Construction pace

For the 12-month period ending June 30, 7,291.03 miles of pipeline construction were proposed to the FERC, of which 60.08 miles were planned for offshore Gulf of Mexico (Table 2).

This total mileage was proposed in 171 construction projects, 2 of which were for offshore.

For the 12-month period July 1, 1988, to June 30, 1989, 2,410.37 miles of pipeline were proposed of which 386.59 miles were planned for offshore.

As stated, a large portion of the land construction filed for approval with the FERC during the period covered consisted of projects being refiled as a result of changes in volumes, diameters, lengths, or compression.

Primarily, these refilings, comprising approximately 2,100 miles of the mileage proposed for the period covered, were for pipelines to serve California markets.

Three new projects, however, are designed to move Canadian gas production into major U.S. interstate systems. One of these, the Altamont project (OGJ, June 5, 1989, p. 33), would tie into the proposed Kern River project (OGJ, June 26, 1989, p. 24) from Wyoming to California.

Even excepting the roughly 2,100 miles of refilings, the remaining mileage of approximately 5,000 miles stands as a significant amount of gas pipeline proposed.

Oil & Gas Journal's Worldwide Construction Report (OGJ, Oct. 15, p. 79) lists 105 individual pipeline projects totaling almost 12,000 miles of U.S. pipeline construction reported by surveyed companies as either proposed, planned, or under way.

By comparison, OGJ's Oct. 16, 1989, construction report listed 70 U.S. pipeline projects proposed, planned, or under way, totaling more than 9,000 miles.

Natural-gas pipeline projects reported in this year's construction report total more than 10,500 miles of pipeline. The report a year ago listed gas-pipeline projects totaling more than 8,300 miles.

Prospects for many of these lines being built are better now than at any time in the last 5 years.

Nonetheless, many projects are competing for the same markets, as Table 2 shows, or may still become uneconomical in the currently shifting petroleum markets.

This seems especially true for pipelines proposed to bring natural gas from Canadian producers into the U.S., the major system additions and expansions into the U.S. Northeast, and projects competing to supply natural gas to EOR projects and power-generation, commercial, and residential markets in California.

Crude-oil projects in the latest Oil & Gas Journal Worldwide Construction Report total 13 comprising more than 1,000 miles. Here, also, the construction report a year ago listed eight crude-oil pipeline projects totaling more than 900 miles.

Finally, the latest Journal report shows five product-pipeline projects with more than 350 miles of pipeline. A year ago, five projects totaling 75 miles were reported.

### U.S. interstate network

Revenue, income, and mileage changes cited earlier are evident on the pipeline-company tables (pp. 58-63).

These data are based on annual reports of the regulated interstate pipeline companies and provide a variety of detail on each of them, including pipeline mileage, crude-oil and refined-products deliveries, natural-gas sales and deliveries of gas for others, operating revenues, and net incomes.

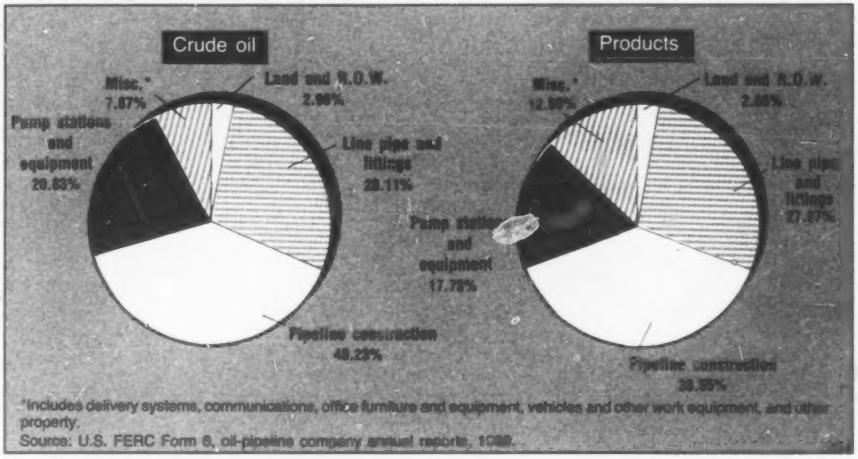
Beginning with the 1988

*WORKERS prepare to coat a field weld with a thin-film epoxy to protect this Natural Gas Pipeline Co. of America pipeline against corrosion. NGPL installed 191 miles of pipeline and built a compressor station during construction of its A/G line in southern Oklahoma and northeastern Texas earlier this year (Roy Pope, NGPL, photographer).*

Pipeline Economics Report (OGJ, Nov. 28, 1988, p. 33), the Journal began tracking volumes of gas transported for others by major interstate pipeline systems. This provides a method of keeping track of the changing nature of the U.S. gas-transmission industry.

Fig. 2

**Liquids-pipeline investment**

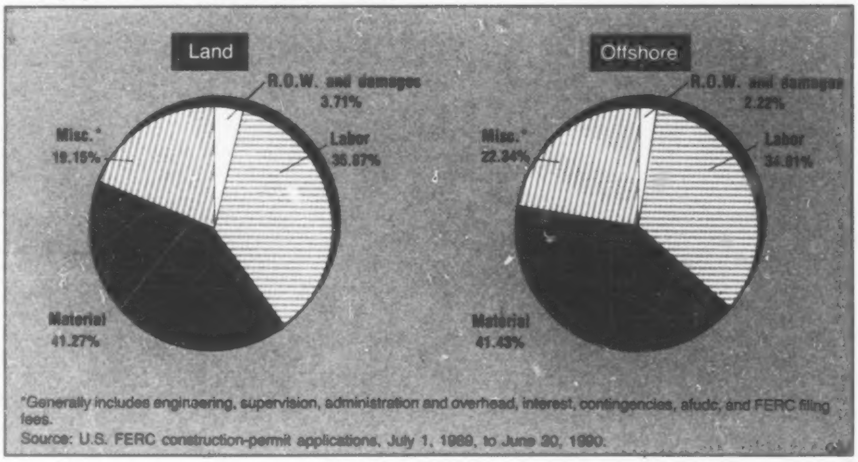


*Includes delivery systems, communications, office furniture and equipment, vehicles and other work equipment, and other property.

Source: U.S. FERC Form 6, oil-pipeline company annual reports, 1989.

Fig. 3

**Gas-pipeline construction costs**



*Generally includes engineering, supervision, administration and overhead, interest, contingencies, afudc, and FERC filing fees.

Source: U.S. FERC construction-permit applications, July 1, 1989, to June 30, 1990.

### System utilization

Comparisons between any years of U.S. petroleum and natural-gas pipeline mileages must be made with care for two reasons:

The number of companies required to file reports with the FERC varies each year, and the FERC's system for classifying interstate natural-gas pipeline companies changed with the 1984 reporting year (OGJ, Nov. 25, 1985, p. 55).

Since 1984, companies are classified as "major" or "nonmajor" based on total natural-gas transmissions for each of the 3 immediately previous reporting years. (See FERC Accounting and Reporting Requirements for Natural Gas Companies, para. 20-011.)

Major pipeline companies are those whose combined gas sold for resale and gas transported or stored for a fee exceeded 50 bcf at 14.73 psi (60° F.) in each of the 3 previous calendar years.

Nonmajors are companies not classified as majors and which have had total gas sales of volume transactions exceeding 200 MMcf at 14.73 psi (60° F.) in each of the 3 previous calendar years.

One effect of this change has been that companies classified as nonmajor are exempt from filing certain data. Chief among the excluded figures are mileage and gas sales or transportation figures.

Many nonmajor companies nonetheless file such data voluntarily, but consistency exists only among major companies.

In comparison, figures for nonmajor companies should be excluded from a calculation of total U.S. interstate pipeline utilization for any given year because of their unreliability year to year.

Therefore, combining 1989 mileage data for all regulated liquids-pipeline companies (168,637) with mileage reported by the major natural-gas pipeline companies (46 companies reporting 241,685 miles) yields a total figure of 410,322. This represents a 3.3% decrease of 14,200 miles over comparable figures reported for 1988 (170,457 + 254,065 = 424,522).

This compares with a small increase for 1988 over 1987 of 4,210 miles for all liquids and major natural-gas pipelines.

At the end of 1989, reports from liquids-pipeline companies show a total of 33,349 miles of gathering lines, 55,664 miles of crude-oil trunk lines, and 79,624 miles of products pipelines.

Whether a liquids pipeline company must file an FERC annual report (Form 6) is determined by whether the FERC designates the company as an interstate common-carrier pipeline.

These reports for 1989 show that gathering lines decreased by 962 miles (−2.8%). Crude lines decreased by 236 miles (−0.42%) and products lines by 622 miles (−0.78%) over totals reported for 1988.

These figures are in line with the erratic pattern of liquids-pipeline utilization for the past 8 years (Table 3).

Natural-gas transmission lines for all companies were down over 1988 by 7,980 miles (−2.84%) and for major companies by 12,380 miles (−4.87%).

Field lines for all companies showed a fractional decrease of 1,414 miles (−0.69%) and a loss of 4,322 miles (−2.31%) among major companies.

For all companies as well as majors, storage lines decreased last year over 1988: down 9,192 miles (−12.7%) for all companies, 7,772 miles (−12.38%) for majors.

### Deliveries

Throughput for liquids-pipeline companies in 1989 fell slightly over 1988. And for all natural-gas pipelines, sales of gas fell slightly in

## Top 10 interstate liquids pipelines—1989

| Company | Mileage* | Company | Trunkline traffic, million bbl-miles | Company | Income $1,000 |
|---|---|---|---|---|---|
| 1. Amoco Pipeline Co. (C) | 12,153 | Colonial Pipeline Co. (P) | 588,436 | Exxon Pipeline Co. (C) | 356,501 |
| 2. Mobil Pipe Line Co. (C) | 9,721 | Lakehead Pipe Line Co. Inc. (P) | 354,845 | BP Pipeline (Alaska) Inc. (C) | 342,478 |
| 3. Exxon Pipeline Co. (C) | †9,339 | Explorer Pipeline Co. (P) | 126,813 | ARCO Pipe Line Co. (C) | 198,389 |
| 4. Chevron Pipe Line Co. (P) | 8,123 | Amoco Pipeline Co. (C) | 1[illegible],487 | Colonial Pipeline Co. | 156,531 |
| 5. Conoco Pipe Line Co. (C) | 7,895 | Plantation Pipe Line Co. (P) | 118,323 | Amoco Pipeline Co.(C) | 91,611 |
| 6. Shell Pipe Line Co. (C) | 7,244 | Shell Pipe Line Corp. (C) | 101,493 | Chevron Pipe Line Co. (P) | 78,010 |
| 7. Mid-America Pipeline Co. (P) | 7,001 | Marathon Pipe Line Co. (C) | 81,910 | Mobil Pipe Line Co. (C) | 68,157 |
| 8. ARCO Pipe Line Co. (C) | †6,850 | Mobil Pipe Line Co. (C) | 77,075 | Southern Pacific Pl. Part.L.P. (P) | 59,884 |
| 9. Williams Pipe Line Co. (P) | 6,845 | Texaco Pipeline Inc. (C) | 75,380 | Kuparak Transportation Co. (C) | 56,308 |
| 10. Texaco Pipeline Co. (C) | 6,337 | Chevron Pipe Line Co. (P) | 71,382 | Shell Pipe Line Corp. (C) | 56,045 |
| Total | 81,308 |  | 1,798,143 |  | 1,457,912 |
| Part of all companies, % | 48.21 |  | 51.34 |  | 65.48 |
| 1988 totals | 81,794 |  | 2,237,645 |  | 1,619,884 |

*C = mostly or exclusively crude oil; P = mostly or exclusively product. †Includes 818 miles for Trans-Alaska Pipeline; to avoid duplication, the total includes 818 miles only once.

Source: U.S. FERC Form 6: Annual Report of Oil Pipeline Companies, Dec. 31, 1989.

## Top 10 U.S. gas-pipeline companies—1989

| Company | Mileage | Company | Sales, MMcf | Company | Net income, $1,000 |
|---|---|---|---|---|---|
| 1. Northern Natural, Div. of Enron | 20,832 | Texas Eastern Transmission Corp. | 525,360 | Tennessee Gas Pipeline Co. | 669,747 |
| 2. Columbia Gas Transmission Corp. | 18,716 | Columbia Gas Transmission Corp. | 432,813 | Enron Corp./ Northern Natural Pl. | 226,393 |
| 3. Enron Corp./Northern Natural, Pl. | 16,671 | United Cities Gas Co. | 402,806 | ANR Pipeline Co. | 170,693 |
| 4. Tennessee Gas Pipeline Co. | 14,459 | Pacific Gas Transmission Co. | 373,328 | El Paso Natural Gas Co. | 154,459 |
| 5. Natural Gas Pipeline Co. of America | 12,752 | Natural Gas Pipeline Co. of America | 369,970 | Texas Eastern Transmission Corp. | 152,991 |
| 6. Panhandle Eastern Pipe Line Co. | 12,595 | Enron Corp./ Northern Natural Pl | 332,779 | Natural Gas Pipeline Co. of America | 111,696 |
| 7. K N Energy Inc. | 12,248 | Florida Gas Transmission Co. | 272,040 | Southern Natural Co. | 91,777 |
| 8. ANR Pipeline Co. | 11,624 | Arkla Inc. | 247,490 | Enserch Corp. | 73,352 |
| 9. Transcontinental Gas Pipe Line Corp. | 10,770 | CNG Transmission Corp. | 242,904 | Colorado Interstate Gas Co. | 67,639 |
| 10. Enserch Corp. | 10,583 | Tennessee Gas Pipeline Co. | 235,235 | Columbia Gas Transmission Corp. | 65,365 |
| Totals | 141,050 |  | 3,434,727 |  | 1,784,102 |
| Part of majors, % | 58.36 |  | 61.82 |  | 83.53 |
| Part of all companies, % | 51.59 |  | 48.14 |  | 71.53 |
| 1988 totals | 149,117 |  | 3,536,180 |  | $1,618,630 |

Source: U.S. FERC Forms 2 & 2A: annual reports for natural gas companies, Dec. 31, 1989.

1989, by 827.6 bcf (−12.96%) for majors and by 388.6 bcf (−5.17%) for all companies.

But the major story continues to be the shift of natural-gas pipeline companies from their historic role as buyers-for-resale of gas to transporters. This shift has been evolving for almost 6 years and was evident in 1988 in the volumes of gas regulated interstate pipeline companies transported for others.

For last year, all regulated U.S. interstate gas pipelines carried 19.1 tcf of gas for others; of those volumes, majors carried slightly more than 17.1 tcf.

For all companies, volumes of gas transported for others rose 2.6 tcf (15.73%); for majors the rise was almost 1.5 tcf (9.49%).

Volumes of gas transported for others in 1989 by all interstate gas-pipeline companies (19.1 tcf) comprised 72.9% of total volumes (26.28 tcf) moved through the U.S. system, up from 68% for 1988.

For major companies (whose total volumes exceeded 22.7 tcf), the share was a bit larger: more than 75.5%. This share also represented an increase over the 1988 figure, up from 71%.

Crude-oil and product deliveries last year approached 11.3 billion bbl, a decrease over 1988 of 202.7 million bbl (−1.76%).

Crude-oil deliveries through the U.S. interstate system fell slightly last year by 74.8 million bbl (−1.15%). Product deliveries also declined by 127.8 million bbl (−2.57%).

Trunkline traffic for U.S. crude-oil and product pipelines also showed decline last year when compared to 1988. It fell by 114 billion bbl-miles (−3.15%) over that for 1988.

Crude-oil trunkline traffic declined 51.6 billion bbl-miles (−2.62%). Product traffic also fell, 62.4 billion bbl-miles (−3.79%).

### Rankings

Oil & Gas Journal ranks the top 10 natural-gas and liquids pipeline companies in three categories: mileage, natural-gas sales or liquids barrel-mile throughput, and operating income (p. 46).

These rankings are broken out from the pipeline-company tables (pp. 58-63).

For all natural-gas pipeline companies, net income as a portion of gas-plant investment continued a trend begun in 1988. This portion stood at 4.6% for 1989, up from 3.1% for 1988. The 1988 figure was up from 2.9% in 1987. It was 3.4% in 1986, 4.5% in 1985, and 8.7% in 1984.

For major gas pipelines, net income as a portion of gas-plant investment mirrored the trend, rising to 4.8% in 1989 after the figure had risen to 3.2% for 1988. It fell to 2.6% in 1987 from 3.2% in 1986. It was 4.3% in 1985, and 7.6% in 1984.

For 1989, all gas compa-

Table 1

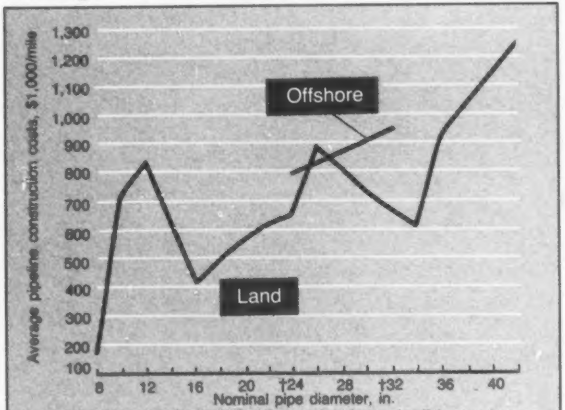
## Revenues, incomes: 10 years

|  | Gas |  | Oil |  |
|---|---|---|---|---|
|  | Operating rev., $1,000 | Net income, $1,000 | Operating rev., $1,000 | Net income, $1,000 |
| 1980 | 48,128,791 | 3,038,018 | 6,356,037 | 1,912,411 |
| 1981 | 57,792,315 | 3,810,566 | 6,678,039 | 2,030,667 |
| 1982 | 64,850,548 | 3,566,041 | 7,140,459 | 2,162,447 |
| 1983 | 66,261,738 | 3,565,776 | 7,472,286 | 2,352,748 |
| 1984 | *64,006,035 | *4,055,700 | 7,823,582 | 2,544,764 |
| 1985 | *56,252,921 | *5,190,817 | 7,460,847 | 2,430,845 |
| 1986 | *40,664,635 | *1,653,010 | 7,287,062 | 2,051,372 |
| 1987 | *31,596,171 | *1,438,203 | 7,057,264 | 2,475,411 |
| 1988 | *32,738,380 | *1,572,609 | 6,861,926 | 2,504,986 |
| 1989 | *32,343,805 | *2,494,238 | 6,511,997 | 2,226,627 |

Source: U.S. FERC annual reports by regulated interstate natural-gas and liquids pipeline companies.
*Major and nonmajor companies under the FERC's classification system for natural-gas pipeline companies effective beginning with the 1984 reporting year. See table GAS COMPANIES, p. 61, for definition of major and nonmajor companies.

Fig. 4

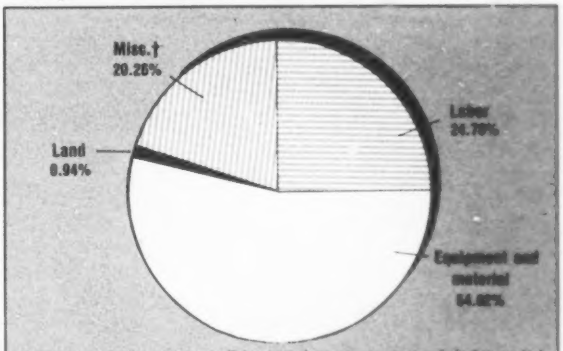
## Average construction costs*



*Gas-pipeline construction in U.S. †One project for each offshore category.
Source: U.S. FERC construction-permit applications, July 1, 1989, to June 30, 1990.
OGJ

Fig. 5

## Compressor-station costs*

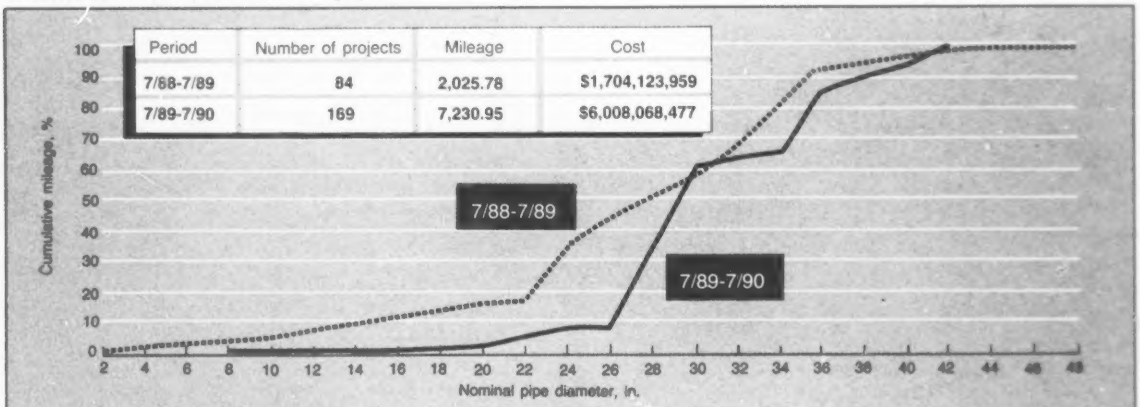


*Land construction only; no offshore stations were proposed during period covered. †Generally includes engineering, supervision, administration and overhead, interest, contingencies, afudc, and FERC filing fees.

Source: U.S. FERC construction-permit applications, July 1, 1989, to June 30, 1990.
OGJ

Fig. 6

## Diameter distribution for pipelines*



| Period | Number of projects | Mileage | Cost |
|---|---|---|---|
| 7/88-7/89 | 84 | 2,025.78 | $1,704,123,959 |
| 7/89-7/90 | 169 | 7,230.95 | $6,008,068,477 |

*U.S. land, gas pipelines.
Source: U.S. FERC construction-permit applications July 1, 1988, to June 30, 1990.
OGJ

nies reported an industry gas-plant investment totaling almost $54.2 billion compared to $51 billion in 1988, $49.9 billion for 1987, $49.4 billion for 1986, and $48.3 billion for 1985.

Majors' gas-plant investment in 1989 increased to $44.2 billion from $44 billion in 1988, slightly less than $42 billion for 1987, and $42.2 billion for 1986.

For interstate common-carrier liquids pipeline companies, net income as a percentage of investment in carrier property fell to 9% in 1989 from 10.3% in 1988 and 11.6% in 1987. It was 9.2% in 1986, 11.3% in 1985, and 13.1% in 1984.

Liquids pipelines' investment in carrier property for 1989 increased by more than $306 million (1.26%) to $24.6 billion over 1988 which had shown a $2.9 billion increase (+14%) over 1987.

This latter year investment in carrier property had fallen to slightly less than $22.3 billion compared with $22.4 billion for 1986, $21.6 billion in 1985, and $19.4 billion in 1984.

Another measure of the profitability of oil and natural-gas pipeline companies in recent years is the percentage net income represents of operating income. Through 1987, trends for liquids-pipeline companies and for natural-gas pipeline companies had been heading in opposite directions for 10 years.

For liquids-pipeline companies in 1989, this figure fell to 34.2% from 36.5% in 1988. For 1987, the figure was 35%; it was 28% in 1986 and 21.9% in 1978.

The figure for 1986 had represented the only year the percentage has declined (from 32.6% for 1985).

By contrast for all natural-gas pipeline companies, income as a percentage of operating revenues has been steadily falling in the past 10 years.

Last year, however, saw a strengthening in this area: net income as a portion of operating revenues was 7.7%. At the end of 1988, it had increased to 4.8% from 4.5% for 1987, the latter portion fractionally higher than for 1986.

The 10-year decline is evident when the portion for 1978 is noted: 8.3%.

For majors in 1989, income as a percentage of operating revenues was 8.2%; for 1988, 5.3%.

### Tracked companies

In this annual Pipeline Economics Report, Oil & Gas Journal has for several years been tracking investments by five crude-oil pipeline companies and five products-pipeline companies.

Table 4 indicates that investments by the five crude-oil pipelines stood at $1.75 billion at the end of 1989

# Current pipeline costs

| Size, in. | Location* | Length, miles | Cost, $ Material | Labor | Misc.† | R.O.W. & damages | Total | $/mile |
|---|---|---|---|---|---|---|---|---|
| **LAND PIPELINES** | | | | | | | | |
| 8 | Tennessee | 2.14 | 128,000 | 298,000 | 171,900 | 56,000 | 653,900 | 305,561 |
| 8 | Tennessee | 2.66 | 147,000 | 370,000 | 190,000 | 51,000 | 758,000 | 284,962 |
| 8 | Tennessee | 6.34 | 322,000 | 960,000 | 394,200 | 63,000 | 1,739,200 | 274,322 |
| 8 | Utah-Idaho | 11.00 | 389,850 | 349,000 | 129,900 | 3,000 | 871,750 | 79,250 |
| 10 | Massachusetts (R) | 0.09 | 23,300 | 83,000 | 113,940 | 16,200 | 236,440 | 2,627,111 |
| 10 | Rhode Island | 2.31 | 296,600 | 677,200 | 560,020 | 266,500 | 1,800,320 | 779,359 |
| 10 | Massachusetts | 8.62 | 965,300 | 2,786,800 | 1,701,101 | 467,200 | 5,920,401 | 686,821 |
| 12 | Connecticut (L) | 0.90 | 243,000 | 830,000 | 152,488 | 207,000 | 1,432,488 | 1,591,653 |
| 12 | Connecticut (R) | 3.20 | 423,800 | 851,400 | 760,430 | 468,700 | 2,504,330 | 782,603 |
| 12 | Massachusetts | 3.49 | 513,700 | 1,962,200 | 1,339,961 | 473,600 | 4,289,461 | 1,229,072 |
| 12 | New Hampshire | 4.47 | 612,900 | 1,279,300 | 811,980 | 327,100 | 3,031,280 | 678,139 |
| 12 | Massachusetts | 6.13 | 792,700 | 1,513,800 | 1,165,620 | 436,000 | 3,908,120 | 637,540 |
| 16 | Alabama | 2.19 | 604,500 | 461,900 | 196,475 | 44,800 | 1,307,675 | 597,112 |
| 16 | Pennsylvania (L) | 2.25 | 511,101 | 852,445 | 322,031 | 69,087 | 1,754,664 | 779,851 |
| 16 | Connecticut (L) | 3.10 | 742,000 | 2,563,000 | 351,555 | 695,000 | 4,351,555 | 1,403,727 |
| 16 | California (L) | 4.40 | 667,000 | 951,000 | 487,000 | 422,000 | 2,527,000 | 574,318 |
| 16 | Iowa | 24.30 | 2,631,206 | 1,515,000 | 1,420,044 | 1,005,000 | 6,571,250 | 270,422 |
| 16 | Wisconsin | 24.80 | 2,639,363 | 3,404,630 | 1,896,448 | 1,575,000 | 9,515,441 | 383,687 |
| 20 | Alabama | 0.10 | 330,300 | 91,900 | 70,025 | 2,100 | 494,325 | 4,943,250 |
| 20 | Tennessee (R) | 2.13 | 397,000 | 900,000 | 403,600 | 77,000 | 1,777,600 | 834,554 |
| 20 | Louisiana (L) | 2.86 | 538,600 | 563,900 | 398,000 | 158,500 | 1,659,000 | 580,070 |
| 20 | Tennessee | 3.26 | 486,000 | 750,000 | 399,000 | 61,000 | 1,696,000 | 520,245 |
| 20 | Tennessee | 3.37 | 530,000 | 740,000 | 405,200 | 42,000 | 1,717,200 | 509,555 |
| 20 | Kansas | 7.20 | 1,664,806 | 755,653 | 613,759 | 53,936 | 3,088,154 | 428,910 |
| 20 | New Jersey | 8.60 | 1,578,000 | 4,248,000 | 1,908,126 | 1,362,000 | 9,096,126 | 1,057,689 |
| 20 | New York | 9.50 | 2,327,000 | 1,845,000 | 490,533 | 100,000 | 4,762,533 | 501,319 |
| 20 | California | 27.20 | 3,738,000 | 3,616,000 | 2,649,000 | 2,770,000 | 12,773,000 | 469,596 |
| 24 | Alabama | 0.27 | 488,900 | 297,700 | 132,125 | 5,600 | 924,325 | 3,423,426 |
| 24 | Missouri | 0.60 | 119,000 | 115,000 | 62,000 | 30,000 | 326,000 | 543,333 |
| 24 | Massachusetts | 0.64 | 198,900 | 483,200 | 437,161 | 58,400 | 1,177,661 | 1,840,095 |
| 24 | Illinois-Missouri (C) | 0.75 | 168,000 | 2,769,000 | 697,000 | 37,000 | 3,671,700 | 4,894,667 |
| 24 | Virginia (L) | 1.00 | 232,800 | 438,000 | 454,000 | 33,400 | 1,158,200 | 1,158,200 |
| 24 | Massachusetts | 1.50 | 742,000 | 2,538,000 | 385,508 | 220,000 | 3,885,508 | 2,590,339 |
| 24 | Tennessee | 3.61 | 644,000 | 832,200 | 517,600 | 57,800 | 2,051,600 | 568,310 |
| 24 | Pennsylvania | 3.70 | 745,500 | 1,546,000 | 554,988 | 232,800 | 3,079,288 | 832,240 |
| 24 | Virginia (L) | 4.80 | 1,049,500 | 1,748,400 | 1,512,200 | 219,500 | 4,529,600 | 943,667 |
| 24 | Texas | 4.88 | 411,900 | 557,300 | 173,706 | 16,500 | 1,159,406 | 237,583 |
| 24 | Wyoming | 5.70 | 800,000 | 937,000 | 726,130 | 211,000 | 2,674,130 | 469,146 |
| 24 | Wyoming-California | 5.80 | 937,000 | 861,000 | 515,000 | 174,000 | 2,487,000 | 428,793 |
| 24 | Tennessee | 6.41 | 1,030,000 | 1,415,000 | 638,500 | 100,000 | 3,383,500 | 527,847 |
| 24 | Pennsylvania | 7.20 | 1,470,300 | 2,720,200 | 1,025,272 | 456,200 | 5,671,972 | 787,774 |
| 24 | Pennsylvania | 7.30 | 1,856,300 | 2,925,900 | 1,195,982 | 464,000 | 6,442,182 | 882,491 |
| 24 | Pennsylvania | 8.30 | 2,096,500 | 2,908,600 | 1,119,356 | 403,400 | 6,527,856 | 786,489 |
| 24 | Virginia (L) | 8.40 | 1,315,500 | 2,750,400 | 2,148,300 | 119,800 | 6,334,000 | 754,048 |
| 24 | Pennsylvania | 8.40 | 1,677,700 | 3,018,200 | 1,125,156 | 534,100 | 6,355,156 | 756,566 |
| 24 | Massachusetts (R) | 9.60 | 2,404,900 | 4,904,200 | 2,753,950 | 730,400 | 10,793,450 | 1,121,980 |
| 24 | Arizona-California | 17.00 | 3,041,700 | 2,479,440 | 3,591,710 | 112,725 | 9,225,575 | 542,681 |
| 24 | California | 18.40 | 3,304,000 | 2,691,000 | 1,739,000 | 898,000 | 8,632,000 | 469,130 |
| 24 | Pennsylvania | 25.19 | 5,711,000 | 17,790,000 | 3,006,322 | 1,462,000 | 27,969,322 | 1,110,334 |
| 24 | Virginia | 27.00 | 6,398,800 | 9,212,900 | 3,155,284 | 4,573,600 | 23,340,584 | 864,466 |
| 24 | Illinois | 54.90 | 9,455,000 | 11,059,000 | 2,948,000 | 1,180,000 | 24,642,000 | 448,852 |
| 24 | California | 56.30 | 11,569,000 | 10,430,000 | 6,640,000 | 3,606,000 | 32,245,000 | 572,735 |
| 24 | California | 56.30 | 9,136,000 | 8,233,000 | 5,243,000 | 2,846,000 | 25,458,000 | 452,185 |
| 26 | Pennsylvania | 5.10 | 827,700 | 1,758,000 | 1,369,300 | 385,000 | 4,340,000 | 850,980 |
| 26 | West Virginia | 11.20 | 3,073,000 | 4,643,000 | 2,281,154 | 177,000 | 10,174,154 | 908,407 |
| 30 | Alabama | 0.50 | 686,404 | 536,075 | 261,913 | 12,950 | 1,497,342 | 2,994,684 |
| 30 | Massachusetts | 2.92 | 678,800 | 1,788,500 | 1,121,351 | 186,500 | 3,775,151 | 1,292,860 |
| 30 | Colorado (L) | 3.60 | 863,000 | 716,000 | 289,539 | 44,000 | 1,912,539 | 531,261 |
| 30 | Texas (L) | 4.00 | 1,157,839 | 676,096 | 490,065 | 50,000 | 2,374,000 | 593,500 |
| 30 | Iowa (L) | 4.99 | 1,437,973 | 1,104,290 | 1,307,440 | 250,000 | 4,099,703 | 821,584 |
| 30 | Iowa (L) | 6.61 | 1,855,781 | 2,013,985 | 1,304,503 | 295,000 | 5,469,269 | 827,423 |
| 30 | New York | 7.10 | 2,319,700 | 3,208,400 | 1,316,299 | 340,200 | 7,184,599 | 1,011,915 |
| 30 | Texas | 8.30 | 18,140,000 | 4,741,000 | 4,250,000 | 250,000 | 27,381,000 | 3,298,916 |
| 30 | Pennsylvania (L) | 9.59 | 2,205,600 | 4,215,400 | 548,700 | 2,755,010 | 9,724,710 | 1,014,047 |
| 30 | Massachusetts (L) | 10.11 | 2,590,400 | 6,411,600 | 3,344,330 | 795,600 | 13,141,930 | 1,299,894 |
| 30 | Wyoming-California | 13.50 | 3,881,000 | 2,823,000 | 1,641,000 | 392,000 | 8,737,000 | 647,185 |
| 30 | Illinois (L) | 15.00 | 3,611,000 | 3,257,000 | 1,183,000 | 675,000 | 8,726,000 | 581,733 |
| 30 | Alabama | 16.68 | 6,365,000 | 6,513,000 | 2,903,280 | 656,000 | 16,437,280 | 985,448 |
| 30 | Iowa (L) | 17.72 | 4,666,859 | 3,751,450 | 2,714,694 | 895,000 | 12,028,003 | 678,781 |
| 30 | Pennsylvania (L) | 18.25 | 4,133,300 | 8,116,400 | 4,671,140 | 1,023,000 | 17,943,840 | 983,224 |
| 30 | Iowa (L) | 20.69 | 5,653,966 | 4,977,330 | 3,265,182 | 705,000 | 14,601,478 | 705,726 |
| 30 | Wyoming | 25.40 | 9,174,300 | 5,241,700 | 3,628,075 | 696,000 | 18,740,075 | 737,798 |
| 30 | Wyoming-California | 30.20 | 6,923,000 | 6,333,000 | 3,449,000 | 987,000 | 17,692,000 | 585,828 |
| 30 | Wyoming-California | 31.20 | 9,306,000 | 7,446,000 | 4,238,000 | 1,878,000 | 22,868,000 | 732,949 |
| 30 | Wyoming-California | 34.00 | 7,616,000 | 7,123,000 | 3,833,000 | 1,052,000 | 19,624,000 | 577,176 |
| 30 | Louisiana (L) | 51.43 | 22,130,000 | 16,200,000 | 6,003,000 | 2,867,000 | 47,200,000 | 917,752 |
| 30 | Wyoming-California | 55.90 | 15,712,000 | 11,486,000 | 7,149,000 | 3,596,000 | 37,943,000 | 678,766 |
| 30 | Wyoming | 65.10 | 11,530,000 | 14,050,000 | 10,042,716 | 2,332,000 | 37,954,716 | 583,022 |
| 30 | California (L) | 69.30 | 23,042,000 | 13,286,000 | 6,653,000 | 1,142,000 | 44,123,000 | 636,696 |
| 30 | Wyoming-California | 71.50 | 21,478,000 | 16,041,000 | 9,581,000 | 4,413,000 | 51,513,000 | 720,462 |
| 30 | Wyoming-California | 83.40 | 25,967,000 | 17,139,000 | 11,105,000 | 5,769,000 | 59,980,000 | 719,185 |
| 30 | Arizona-California | 91.50 | 23,996,600 | 20,660,085 | 12,004,295 | 3,627,610 | 60,288,590 | 658,892 |
| 30 | Utah | 108.00 | 24,082,000 | 23,083,000 | 18,414,146 | 4,352,000 | 69,931,146 | 647,511 |
| 30 | Arkansas-Mississippi | 112.20 | 34,443,000 | 32,499,000 | 4,295,939 | 6,302,000 | 77,539,939 | 691,087 |
| 30 | Nevada | 113.40 | 27,305,000 | 23,809,000 | 20,857,640 | 8,815,000 | 80,786,640 | 712,404 |
| 30 | Utah | 114.80 | 25,710,000 | 24,070,000 | 19,500,328 | 4,626,000 | 73,906,328 | 643,783 |
| 30 | Wyoming | 124.50 | 37,653,000 | 39,471,000 | 27,801,992 | 6,014,000 | 110,939,992 | 891,084 |

Table 2

| Size, in. | Location* | Length, miles | Cost, $ | | | | | $/mile |
|---|---|---|---|---|---|---|---|---|
| | | | Material | Labor | Misc.† | R.O.W. & damages | Total | |
| 30 | California | 132.10 | 37,354,000 | 27,139,000 | 16,988,000 | 8,789,000 | 90,270,000 | 683,346 |
| 30 | Arizona-California | 142.00 | 42,306,600 | 27,566,160 | 15,055,069 | 940,776 | 85,868,605 | 604,708 |
| 30 | Wyoming-California | 152.90 | 44,709,000 | 41,253,000 | 21,367,000 | 7,095,000 | 114,424,000 | 748,358 |
| 30 | California | 156.00 | 44,049,000 | 32,046,000 | 20,047,000 | 10,379,000 | 106,521,000 | 682,827 |
| 30 | Montana-Wyoming | 240.50 | 65,840,000 | 50,310,000 | 28,542,000 | 6,687,000 | 151,379,000 | 629,435 |
| 30 | Montana | 305.00 | 88,185,600 | 70,411,700 | 65,912,010 | 4,109,600 | 228,618,910 | 749,570 |
| 30 | Wyoming | 315.00 | 90,468,500 | 71,028,300 | 69,834,479 | 2,016,400 | 233,347,679 | 740,786 |
| 30 | Montana-Illinois | 368.50 | 107,637,000 | 80,051,000 | 54,644,510 | 10,298,763 | 252,631,273 | 685,567 |
| 30 | Montana-Wyoming | 620.00 | 236,505,000 | 120,979,000 | 112,551,408 | 8,033,256 | 478,068,664 | 771,078 |
| 34 | Colo.-New Mexico (L) | 11.20 | 2,858,000 | 2,305,000 | 1,030,573 | 627,000 | 6,820,573 | 608,980 |
| 34 | Colo.-New Mexico (L) | 28.80 | 6,896,000 | 5,674,000 | 2,528,670 | 1,613,000 | 16,711,670 | 580,266 |
| 34 | Arizona (L) | 34.70 | 8,127,000 | 8,916,000 | 3,182,890 | 743,000 | 20,968,890 | 604,291 |
| 34 | New Mexico-Arizona (L) | 123.10 | 27,895,000 | 30,655,000 | 11,089,536 | 3,553,000 | 73,192,536 | 594,578 |
| 34 | New Mexico-Arizona (L) | 158.80 | 35,136,000 | 37,566,000 | 21,436,192 | 4,927,000 | 99,065,192 | 623,836 |
| 36 | Massachusetts (L) | 1.90 | 1,127,000 | 2,494,000 | 516,278 | 801,000 | 4,938,278 | 2,599,094 |
| 36 | West Virginia | 2.30 | 1,017,800 | 1,316,300 | 1,331,700 | 30,900 | 3,696,700 | 1,607,261 |
| 36 | Michigan-Wisconsin | 2.40 | 1,529,500 | 1,448,500 | 260,278 | 29,500 | 3,267,778 | 1,361,574 |
| 36 | Kentucky (L) | 2.65 | 1,248,000 | 1,350,000 | 564,000 | 78,000 | 3,240,000 | 1,222,642 |
| 36 | West Virginia (L) | 2.70 | 1,061,400 | 1,474,600 | 1,321,800 | 32,400 | 3,890,200 | 1,440,815 |
| 36 | Virginia | 3.10 | 1,732,000 | 2,166,000 | 1,081,740 | 210,100 | 5,189,840 | 1,674,142 |
| 36 | Pennsylvania (R) | 4.25 | 2,098,000 | 4,285,000 | 931,292 | 500,000 | 7,814,292 | 1,838,657 |
| 36 | Pennsylvania (R) | 5.25 | 3,038,000 | 5,222,000 | 1,130,979 | 633,000 | 10,023,979 | 1,909,329 |
| 36 | Pennsylvania (R) | 5.25 | 3,674,000 | 8,225,000 | 1,548,780 | 644,000 | 14,091,780 | 2,684,149 |
| 36 | West Virginia (L) | 5.80 | 2,081,700 | 3,093,000 | 2,369,200 | 109,400 | 7,653,300 | 1,319,534 |
| 36 | Michigan | 6.80 | 2,273,300 | 3,316,500 | 1,667,497 | 272,000 | 7,529,297 | 1,107,250 |
| 36 | New Jersey | 6.95 | 4,294,000 | 9,538,000 | 2,239,248 | 3,766,000 | 19,837,248 | 2,854,280 |
| 36 | West Virginia | 7.70 | 3,597,000 | 4,568,000 | 2,222,233 | 91,000 | 10,478,233 | 1,360,809 |
| 36 | Michigan-Wisconsin (L) | 8.20 | 4,956,200 | 4,855,000 | 892,334 | 100,900 | 10,804,434 | 1,317,614 |
| 36 | Pennsylvania (L) | 8.22 | 4,190,223 | 4,786,946 | 1,979,335 | 386,600 | 11,343,104 | 1,379,940 |
| 36 | West Virginia | 8.50 | 3,723,000 | 4,862,000 | 2,390,131 | 124,000 | 11,099,131 | 1,305,780 |
| 36 | New York | 8.54 | 3,094,300 | 4,268,600 | 3,282,770 | 362,700 | 11,008,370 | 1,289,036 |
| 36 | West Virginia | 8.90 | 4,199,000 | 5,411,000 | 2,647,525 | 380,000 | 12,637,525 | 1,419,947 |
| 36 | Michigan-Wisconsin (L) | 9.20 | 5,162,300 | 3,517,500 | 899,234 | 113,200 | 9,692,234 | 1,053,504 |
| 36 | Michigan | 9.20 | 3,943,900 | 5,005,400 | 2,557,283 | 368,000 | 11,874,583 | 1,290,716 |
| 36 | Michigan-Wisconsin | 9.60 | 4,165,400 | 4,449,600 | 921,115 | 118,100 | 9,654,215 | 1,005,647 |
| 36 | Kentucky (L) | 9.87 | 3,912,500 | 4,939,400 | 2,796,600 | 380,500 | 12,029,000 | 1,218,744 |
| 36 | New York (L) | 11.00 | 4,106,400 | 5,140,800 | 3,716,180 | 550,700 | 13,514,080 | 1,228,553 |
| 36 | Massachusetts | 11.04 | 3,962,700 | 8,723,800 | 4,441,160 | 594,800 | 17,722,460 | 1,605,295 |
| 36 | Michigan-Wisconsin (L) | 12.50 | 5,342,200 | 6,233,800 | 1,208,793 | 153,800 | 12,938,593 | 1,035,087 |
| 36 | Arizona-California | 12.50 | 4,676,700 | 2,793,274 | 1,972,734 | 491,425 | 9,934,133 | 794,731 |
| 36 | Michigan-Wisconsin (L) | 13.80 | 5,936,400 | 4,809,800 | 1,268,773 | 169,700 | 12,184,673 | 882,947 |
| 36 | New York (L) | 15.21 | 5,337,500 | 6,914,400 | 5,197,500 | 618,500 | 18,067,900 | 1,187,896 |
| 36 | Michigan-Wisconsin (L) | 16.90 | 9,206,400 | 8,878,100 | 1,764,149 | 207,900 | 20,056,549 | 1,186,778 |
| 36 | New York (L) | 18.18 | 6,438,300 | 8,452,600 | 5,946,210 | 887,300 | 21,724,410 | 1,194,962 |
| 36 | Michigan-Wisconsin (L) | 21.00 | 9,535,800 | 8,518,500 | 1,995,349 | 258,300 | 20,307,949 | 967,045 |
| 36 | New York (L) | 21.27 | 7,817,400 | 13,832,600 | 7,660,070 | 1,263,600 | 30,573,670 | 1,437,408 |
| 36 | Arizona (L) | 39.80 | 10,796,000 | 10,574,000 | 3,908,750 | 480,000 | 25,758,750 | 647,205 |
| 36 | Arizona (L) | 48.60 | 12,913,000 | 13,238,000 | 4,777,745 | 585,000 | 31,513,745 | 648,431 |
| 36 | New Mexico-Arizona (L) | 50.40 | 13,636,000 | 13,949,000 | 7,773,048 | 606,000 | 35,964,048 | 713,572 |
| 36 | Oklahoma-Arkansas | 240.15 | 95,235,000 | 78,004,000 | 10,620,517 | 7,826,000 | 191,685,517 | 798,191 |
| 36 | Wyoming-California | 676.20 | 292,307,000 | 220,689,900 | 113,000,336 | 16,496,500 | 642,493,736 | 950,153 |
| 42 | Michigan-Wisconsin (L) | 4.20 | 2,683,300 | 2,732,300 | 471,437 | 51,700 | 5,938,737 | 1,413,985 |
| 42 | Michigan-Wisconsin (C) | 4.60 | 6,900,000 | 13,600,000 | 2,705,507 | — | 23,205,507 | 5,044,675 |
| 42 | Michigan-Wisconsin (L) | 7.90 | 4,528,200 | 5,112,100 | 860,934 | 97,200 | 10,598,434 | 1,341,574 |
| 42 | Michigan-Wisconsin (L) | 10.40 | 5,765,000 | 5,742,700 | 1,101,773 | 127,900 | 12,737,373 | 1,224,747 |
| 42 | Michigan-Wisconsin (L) | 10.50 | 5,773,800 | 6,098,900 | 1,118,193 | 129,200 | 13,120,093 | 1,249,533 |
| 42 | Michigan-Wisconsin (L) | 11.30 | 5,991,000 | 7,452,600 | 1,221,432 | 139,000 | 14,804,032 | 1,310,091 |
| 42 | Michigan-Wisconsin (L) | 12.20 | 7,059,100 | 6,603,000 | 1,299,032 | 150,100 | 15,111,232 | 1,238,626 |
| 42 | Michigan-Wisconsin (L) | 12.20 | 6,381,100 | 7,409,100 | 1,300,332 | 150,100 | 15,240,632 | 1,249,232 |
| 42 | Michigan-Wisconsin (L) | 12.70 | 6,852,700 | 7,665,400 | 1,359,251 | 156,200 | 16,033,551 | 1,262,484 |
| 42 | Michigan-Wisconsin (L) | 13.70 | 7,588,200 | 7,346,700 | 1,445,771 | 168,500 | 16,549,171 | 1,207,969 |
| 42 | Michigan-Wisconsin (L) | 13.80 | 7,505,400 | 9,355,300 | 1,507,610 | 169,700 | 18,538,010 | 1,343,334 |
| 42 | Michigan-Wisconsin (L) | 14.70 | 8,204,000 | 8,899,700 | 1,577,373 | 180,800 | 18,861,873 | 1,283,121 |
| 42 | Michigan-Wisconsin (L) | 15.20 | 8,100,800 | 9,099,800 | 1,617,729 | 187,000 | 19,005,329 | 1,250,351 |
| 42 | Michigan-Wisconsin (L) | 15.60 | 8,306,100 | 10,651,700 | 1,701,868 | 191,900 | 20,851,568 | 1,336,639 |
| 42 | Michigan-Wisconsin (L) | 16.40 | 9,060,300 | 10,983,800 | 1,794,588 | 201,700 | 22,040,388 | 1,343,926 |
| 42 | Michigan-Wisconsin (L) | 18.80 | 10,180,500 | 10,879,800 | 1,991,488 | 231,200 | 23,282,988 | 1,238,457 |
| 42 | Michigan-Wisconsin (L) | 29.80 | 16,217,700 | 18,567,000 | 3,214,258 | 366,500 | 38,365,458 | 1,287,431 |
| 42 | Michigan-Wisconsin (L) | 31.10 | 16,786,800 | 19,526,600 | 3,352,578 | 382,500 | 40,048,478 | 1,287,732 |
| 42 | Idaho-California (L) | 48.20 | 25,045,365 | 14,253,180 | 14,422,443 | 214,274 | 53,935,262 | 1,118,989 |
| 42 | Idaho-California (L) | 51.10 | 27,414,900 | 34,070,900 | 5,555,002 | 628,500 | 67,669,302 | 1,[illegible]24,252 |
| 42 | Michigan-Wisconsin (L) | 52.80 | 27,921,700 | 27,612,900 | 5,480,465 | 649,400 | 61,664,465 | 1,167,888 |
| 42 | Michigan-Wisconsin (L) | 52.80 | 28,316,000 | 29,946,900 | 5,579,824 | 649,400 | 64,492,124 | 1,221,442 |
| 42 | Michigan-Wisconsin (L) | 54.60 | 28,754,800 | 29,380,800 | 5,700,243 | 671,600 | 64,507,443 | 1,181,455 |
| 42 | Idaho-California (L) | 55.50 | 28,815,635 | 16,398,820 | 16,593,564 | 246,531 | 62,054,550 | 1,118,100 |
| 42 | Michigan-Wisconsin (L) | 60.20 | 33,262,700 | 46,013,100 | 6,780,411 | 745,500 | 86,796,711 | 1,441,806 |
| 42 | Michigan-Wisconsin (L) | 74.20 | 40,192,500 | 41,764,600 | 7,857,309 | 912,700 | 90,727,109 | 1,222,737 |
| 42 | Idaho-California (L) | 95.60 | 44,771,000 | 42,358,000 | 31,595,990 | 462,236 | 119,187,226 | 1,246,728 |
| 42 | Idaho-California (L) | 96.40 | 43,593,000 | 31,741,000 | 27,953,077 | 415,081 | 103,702,158 | 1,075,749 |
| 42 | Arizona-California | 121.50 | 69,147,200 | 38,486,241 | 27,996,030 | 4,815,965 | 140,445,436 | 1,155,930 |
| 42 | Idaho-California (L) | 134.30 | 66,762,000 | 58,830,000 | 45,449,024 | 663,135 | 171,704,159 | 1,278,512 |
| **Total land projects** | | **7,230.95** | **$2,479,581,871** | **$2,155,136,500** | **$1,150,306,546** | **$223,043,560** | **$6,008,068,477** | **$830,882** |
| 1989-report total/land | | 2,023.78 | $627,865,702 | $732,263,552 | $276,475,508 | $67,519,197 | $1,704,123,959 | $842,050 |
| **OFFSHORE PIPELINES** | | | | | | | | |
| 24 | Alabama | 49.66 | 16,107,389 | 13,781,609 | 9,414,359 | 795,335 | 40,098,692 | 807,465 |
| 32 | Alabama | 10.42 | 4,654,207 | 3,260,316 | 1,778,212 | 318,715 | 10,011,450 | 960,792 |
| **Total offshore projects** | | **60.08** | **$20,761,596** | **$17,041,925** | **$11,192,571** | **$1,114,050** | **$50,110,142** | **834,057** |
| 1989 report total/offshore projects | | 386.59 | $119,134,253 | $111,873,716 | $53,561,767 | $530,457 | $285,100,193 | $737,474 |
| **TOTAL/ALL PROJECTS** | | **7,291.03** | **$2,500,343,467** | **$2,172,178,425** | **$1,161,499,117** | **224,157,610** | **6,058,178,619** | **$830,908** |

Source: U.S. FERC construction permit applications, July 1, 1988, to June 30, 1989.

*L = Loop; R = Replacement; C = River or channel crossing. † Generally includes engr., supv., interest, adm. & overheads, contingencies, Afudc, and FERC fees.

compared to $1.71 billion at the end of 1988. That year's figure compares with $1.66 billion at the end of 1987.

Investment by the five products pipeline companies was $2.942 billion for 1989 compared to $2.934 billion at the end of 1988 and $2.890 billion at the end of 1987.

Fig. 2 illustrates the investment split in the crude-oil and products pipeline companies.

## Construction activity

As Fig. 2 shows, the costs of line pipe and fittings and of laying pipelines make up roughly 70% of the cost of a pipeline system. These elements of pipeline construction costs have risen very little for the past few years, after rapidly increasing before 1982.

### Cost trends

Table 5 lists a 10-year land-construction cost trend for natural-gas pipelines with diameters ranging from 8 to 36 in. The table's data are based on a mix of actual costs of completed pipeline construction and projected costs filed under CP dockets with the FERC.

Table 3

## U.S. interstate pipeline mileage

| Year | Miles<br>Gas | <br>Liquid | <br>Total |
|---|---|---|---|
| 1980 | 274,248 | 172,673 | 446,921 |
| 1981 | 274,634 | 172,815 | 447,449 |
| 1982 | 286,999 | 172,549 | 459,548 |
| 1983 | 285,204 | 167,819 | 453,023 |
| 1984 | *258,379 | 173,922 | *432,301 |
| 1985 | *279,395 | 171,401 | *450,796 |
| 1986 | *281,881 | 170,014 | *451,895 |
| 1987 | *280,085 | 167,865 | *447,950 |
| 1988 | *281,381 | 170,457 | *451,838 |
| 1989 | *273,401 | 168,637 | *442,038 |

*Reflects mileage operated as reported under the FERC's classification system for natural-gas pipeline companies effective beginning with the 1984 reporting year. Only major gas-pipeline companies are required to file mileage. See table GAS COMPANIES, p. 61, for definition of major and nonmajor companies and details of companies reporting mileage for 1989.

Source: U.S. FERC Form 6, annual reports for oil-pipeline companies; Forms 2 & 2A, annual reports for natural-gas pipeline companies.

As the table reflects, the average cost per mile for any given diameter may fluctuate from one year to the next as projects' costs are affected by geographic location, terrain, population density, or other factors.

The cost-per-mile trends from 1989 to 1990 are up, with four of seven diameter classifications showing increases. These are for 12, 16, 24, and 30-in. categories.

Yearly fluctuations in these figures are illustrated in construction figures for a 12-in. pipeline. These had leaped between 1984 and 1985 by 90% but fell in 1988 by more than 30%. For the period reported on in this year's report, however, the total average cost-per-mile for 12-in. pipelines rose substantially.

### Plans and miles

Table 2 lists 169 land-pipeline construction projects and 2 offshore for a total of 171, compared to 84 land and 21 offshore reported in last year's Pipeline Economics Report.

Land projects proposed during the period surveyed represent more than 7,200 miles of pipeline at an estimated price of more than $6 billion and two offshore projects totaling 60 miles estimated to cost $50 million.

Total estimated costs for these projects, land and offshore, reach $6.05 billion.

Total costs of projects surveyed in last year's Pipeline Economics Report ran more than $2 billion divided between $1.7 billion for land and $285 million for offshore.

All projects proposed during the period covered (July 1, 1989, to June 30) represent a huge increase in proposed mileage over the previous 12-month period covered. But several projects, as noted, are refilings. These amount to about 2,100 miles.

The remaining mileage still represents a healthy increase over mileage for the previously surveyed period and

Table 4

## Investment in liquids pipelines

| | Company and investment, $<br>A | <br>B | <br>C | <br>D | <br>E | Total, $ | % |
|---|---|---|---|---|---|---|---|
| **CRUDE PIPELINES INVESTMENT BY FIVE COMPANIES** | | | | | | | |
| Land | 2,153,078 | 814,497 | 292,759 | 1,029,353 | 1,236,081 | 5,525,768 | 0.32 |
| Right-of-way | 12,288,388 | 1,006,210 | 316,392 | 16,578,568 | 15,997,226 | 46,186,786 | 2.64 |
| Line pipe | 138,203,476 | 25,703,218 | 7,797,471 | 98,166,788 | 160,965,781 | 430,836,734 | 24.65 |
| Line pipe fittings | 10,387,524 | 955,700 | 1,386,293 | 18,173,126 | 29,552,566 | 60,455,209 | 3.46 |
| Pipeline construction | 204,045,722 | 27,837,621 | 10,931,879 | 223,969,191 | 236,543,625 | 703,328,038 | 40.23 |
| Buildings | 24,171,582 | 5,013,673 | 2,517,063 | 14,446,340 | 11,470,520 | 57,619,188 | 3.30 |
| Boilers | — | — | — | — | — | — | |
| Pumping equipment | 24,646,028 | 5,524,747 | 2,414,882 | 17,621,540 | 48,174,143 | 98,381,340 | 5.63 |
| Machine tools and machinery | — | — | — | 33,938 | −9,742 | 24,196 | 0.00 |
| Other station equipment | 96,402,176 | 22,635,571 | 4,602,358 | 48,121,742 | 36,323,807 | 208,085,654 | 11.90 |
| Oil tanks | 14,381,418 | 6,079,983 | 5,678,530 | 17,132,526 | 28,805,137 | 72,077,596 | 4.12 |
| Delivery facilities | — | 3,973 | 5,382,864 | 1,572,342 | 6,849,372 | 13,808,551 | 0.79 |
| Communications systems | 1,015,203 | 3,278,416 | 71,545 | 11,853,339 | 3,757,003 | 19,975,506 | 1.14 |
| Office furniture and equipment | 3,145,205 | 295,563 | 255,012 | 2,830,149 | 767,911 | 7,293,840 | 0.42 |
| Vehicles and other work equip. | 9,934,692 | 1,078,032 | 518,113 | 6,676,245 | 416,984 | 18,624,066 | 1.07 |
| Other property | — | 1,399,696 | — | — | 4,432,008 | 5,831,704 | 0.33 |
| **Total** | **$540,774,502** | **$101,626,900** | **$42,165,161** | **$478,206,189** | **$585,262,424** | **$1,748,054,176** | **100.00** |
| **PRODUCT PIPELINES INVESTMENT BY FIVE COMPANIES** | | | | | | | |
| Land | 4,535,405 | 1,763,961 | 572,137 | 1,073,091 | 3,247,187 | 11,191,780 | 0.38 |
| Right-of-way | 29,674,813 | 10,829,964 | 16,907,192 | 8,777,681 | 6,839,606 | 73,029,256 | 2.48 |
| Line pipe | 345,579,941 | 67,590,791 | 99,942,839 | 87,385,038 | 98,402,711 | 698,901,320 | 23.76 |
| Line pipe fittings | 72,723,899 | 12,899,770 | 14,370,980 | 1,743,152 | 22,323,267 | 124,061,268 | 4.22 |
| Pipeline construction | 584,068,773 | 109,254,525 | 184,761,177 | 102,011,453 | 153,971,129 | 1,134,067,057 | 38.53 |
| Buildings | 24,001,307 | 4,101,502 | 4,749,308 | 10,994,655 | 17,091,775 | 60,938,547 | 2.07 |
| Boilers | — | — | — | — | — | — | — |
| Pumping equipment | 45,177,720 | 6,182,370 | 28,552,138 | 28,849,924 | 20,176,729 | 128,938,881 | 4.38 |
| Machine tools and machinery | — | — | — | — | 441,510 | 441,510 | 0.02 |
| Other station equipment | 122,325,732 | 21,791,408 | 34,910,983 | 25,585,067 | 126,711,226 | 331,324,416 | 11.26 |
| Oil tanks | 48,938,264 | 17,525,411 | 9,065,619 | 20,147,096 | 66,656,498 | 162,332,888 | 5.52 |
| Delivery facilities | — | — | 8,729,825 | 10,871,129 | 50,835,414 | 70,436,368 | 2.39 |
| Communication systems | 1,700,822 | 644,085 | 2,366,238 | 9,175,498 | — | 13,886,844 | 0.47 |
| Office furniture and equipment | 11,634,736 | 2,538,234 | 3,095,206 | 652,793 | 1,104,306 | 19,025,275 | 0.65 |
| Vehicles and other work equip. | 6,148,086 | 1,930,413 | 8,668,353 | 2,594,054 | 2,655,948 | 21,996,854 | 0.75 |
| Other property | 73,352,479 | — | 18,092,213 | — | — | 91,444,692 | 3.11 |
| **Total** | **$1,369,861,977** | **$257,052,635** | **$434,784,208** | **$309,860,631** | **$570,457,305** | **$2,942,016,756** | ***100.00** |

Source: U.S. FERC Form 3, Annual Report of Oil Pipeline Companies, Dec. 31, 1989.

Table 5

# 10 year land construction cost trends

| Size | Year* | Average cost, $/mile<br>R.O.W. | Material | Labor | Misc. | Total | Range, $/mile<br>Low | High |
|---|---|---|---|---|---|---|---|---|
| 8 in. | 1990 | 7,814 | 44,573 | 89,295 | 40,018 | 181,700 | 79,250 | 305,561 |
| | 1989 | 33,945 | 130,785 | 330,581 | 83,558 | 578,869 | 520,307 | 692,570 |
| | 1988 | 7,619 | 58,695 | 56,381 | 37,363 | 160,058 | 116,856 | 220,000 |
| | 1987 | 20,032 | 55,430 | 75,568 | 30,581 | 181,611 | 151,193 | 652,036 |
| | 1986 | 14,763 | 44,703 | 63,102 | 32,958 | 155,527 | 137,033 | 193,846 |
| | 1985 | 3,141 | 28,144 | 47,317 | 16,283 | 94,884 | 64,203 | 228,866 |
| | 1984 | 22,339 | 49,974 | 175,733 | 74,086 | 322,132 | 223,767 | 540,655 |
| | 1983 | 6,244 | 48,392 | 89,600 | 23,088 | 167,324 | 159,940 | 178,020 |
| | 1982 | 8,996 | 46,002 | 67,950 | 31,769 | 154,717 | 73,596 | 572,926 |
| | 1981 | 8,119 | 34,860 | 23,528 | 20,884 | 87,391 | 55,981 | 109,078 |
| 12 in. | 1990 | 105,535 | 142,336 | 353,859 | 232,572 | 834,302 | 637,540 | 1,591,653 |
| | 1989 | 43,896 | 96,918 | 227,288 | 79,788 | 447,890 | 191,427 | 1,476,787 |
| | 1988 | 52,772 | 85,487 | 268,169 | 89,656 | 496,085 | 261,697 | 1,873,852 |
| | 1987 | 26,018 | 81,675 | 161,790 | 67,404 | 336,826 | 166,473 | 669,332 |
| | 1986 | 43,656 | 94,786 | 243,533 | 101,683 | 483,657 | 186,180 | 1,201,356 |
| | 1985 | 26,582 | 74,620 | 106,447 | 46,164 | 253,813 | 131,765 | 767,548 |
| | 1984 | 23,035 | 147,750 | 211,783 | 93,481 | 476,050 | 338,872 | 608,685 |
| | 1983 | 5,135 | 91,492 | 73,042 | 20,754 | 190,423 | 177,050 | 218,265 |
| | 1982 | 10,536 | 84,972 | 102,390 | 32,173 | 230,071 | 130,252 | 669,227 |
| | 1981 | 3,855 | 71,444 | 65,613 | 11,861 | 152,773 | 55,981 | 369,018 |
| 16 in. | 1990 | 63,994 | 122,186 | 157,792 | 76,076 | 420,048 | 270,422 | 1,403,727 |
| | 1989 | 25,288 | 99,141 | 145,913 | 54,092 | 324,434 | 236,993 | 1,615,768 |
| | 1988 | 34,217 | 114,232 | 185,798 | 56,558 | 390,805 | 203,181 | 2,256,422 |
| | 1987 | 34,775 | 109,042 | 187,216 | 68,857 | 399,890 | 190,946 | †3,334,886 |
| | 1986 | 21,474 | 104,368 | 183,134 | 53,546 | 362,523 | 302,102 | 1,071,477 |
| | 1985 | 8,511 | 80,529 | 47,708 | 20,091 | 156,839 | 154,746 | 167,876 |
| | 1984 | 15,106 | 131,139 | 111,234 | 82,747 | 340,226 | 231,790 | 363,718 |
| | 1983 | 31,542 | 337,088 | 929,969 | 278,159 | 1,576,758 | 447,890 | 2,370,748 |
| | 1982 | 6,278 | 104,319 | 113,380 | 21,936 | 245,913 | 175,715 | 430,841 |
| | 1981 | 9,203 | 110,684 | 133,968 | 40,424 | 294,279 | 140,674 | 590,112 |
| 20 in. | 1990 | 72,042 | 180,469 | 210,378 | 114,252 | 577,141 | 428,910 | 4,943,250 |
| | 1989 | 82,862 | 202,309 | 446,538 | 135,703 | 867,411 | 366,853 | 2,778,664 |
| | 1988 | 27,225 | 139,302 | 170,120 | 58,787 | 345,225 | 246,260 | 2,776,416 |
| | 1987 | 35,655 | 139,346 | 172,071 | 68,265 | 415,337 | 274,034 | 904,487 |
| | 1986 | 29,227 | 134,332 | 182,623 | 82,657 | 428,839 | 175,000 | 1,077,419 |
| | 1985 | 108,870 | 187,379 | 190,886 | 144,974 | 632,109 | 353,088 | 1,277,454 |
| | 1984 | 16,735 | 175,406 | 190,088 | 63,302 | 445,531 | 226,415 | 616,250 |
| | 1983 | 12,682 | 147,354 | 154,811 | 46,073 | 360,934 | 237,600 | 476,104 |
| | 1982 | 12,284 | 124,148 | 128,148 | 30,649 | 295,229 | 210,378 | 482,464 |
| | 1981 | 8,556 | 122,659 | 114,147 | 30,370 | 275,732 | 227,679 | 1,741,597 |
| 24 in. | 1990 | 54,631 | 193,527 | 277,460 | 123,844 | 649,462 | 237,583 | 4,894,667 |
| | 1989 | 26,328 | 165,032 | 193,096 | 75,348 | 459,804 | 446,819 | 2,186,435 |
| | 1988 | 49,494 | 231,264 | 360,603 | 145,358 | 786,719 | 431,093 | §4,289,167 |
| | 1987 | 34,785 | 254,677 | 271,319 | 110,959 | 671,741 | 405,987 | 2,043,000 |
| | 1986 | 4[illegible]46 | 245,807 | 378,917 | 170,094 | 838,565 | 355,428 | 1,607,660 |
| | 1985 | 26,648 | 296,486 | 305,437 | 151,657 | 780,228 | 469,318 | 4,893,740 |
| | 1984 | 29,133 | 289,487 | 298,521 | 128,390 | 745,531 | 395,676 | 1,772,049 |
| | 1983 | 31,416 | 310,583 | 501,401 | 148,993 | 995,393 | 608,781 | 1,649,454 |
| | 1982 | 28,537 | 508,226 | 807,847 | 120,895 | 1,465,505 | (†) | (†) |
| | 1981 | 30,078 | 269,414 | 395,204 | 127,790 | 822,486 | 350,898 | 826,088 |
| 30 in. | 1990 | 33,430 | 303,009 | 225,208 | 160,097 | 722,744 | 531,261 | 3,298,916 |
| | 1989 | 26,090 | 294,249 | 285,222 | 116,421 | 721,981 | 489,867 | 3,000,000 |
| | 1988 | 47,502 | 260,549 | 322,973 | 137,019 | 768,043 | 526,637 | §4,858,168 |
| | 1987 | 25,506 | 257,158 | 308,383 | 161,008 | 752,054 | 477,195 | 1,584,483 |
| | 1986 | 34,035 | 268,922 | 253,838 | 120,603 | 677,397 | 188,835 | 1,571,948 |
| | 1985 | 60,408 | 320,219 | 314,878 | 152,035 | 847,541 | 668,640 | 5,778,947 |
| | 1984 | 20,885 | 336,043 | 376,631 | 183,034 | 916,592 | 637,546 | 1,413,826 |
| | 1983 | 23,872 | 253,071 | 348,478 | 116,084 | 741,506 | 660,086 | 1,683,143 |
| | 1982 | 20,756 | 296,737 | 362,787 | 93,103 | 773,383 | 548,396 | 1,179,760 |
| | 1981 | 14,135 | 309,364 | 201,037 | 73,281 | 597,817 | 561,358 | 4,684,745 |
| 36 in. | 1990 | 28,792 | 391,256 | 354,475 | 149,048 | 923,571 | 647,205 | 2,854,280 |
| | 1989 | 35,408 | 417,820 | 529,578 | 180,613 | 1,163,419 | 832,407 | 2,410,057 |
| | 1988 | 59,395 | 385,007 | 449,650 | 204,591 | 1,098,643 | 758,869 | 2,625,105 |
| | 1987 | 45,461 | 415,118 | 637,294 | 144,784 | 1,242,657 | 1,170,963 | 1,923,266 |
| | 1986 | 360,582 | 428,572 | 468,960 | 151,769 | 1,085,359 | 714,286 | 5,264,368 |
| | 1985 | 21,967 | 389,751 | 296,742 | 157,536 | 865,9[illegible]7 | 629,179 | 6,443,590 |
| | 1984 | 36,063 | 358,876 | 362,667 | 152,787 | 910,393 | 665,480 | 2,143,680 |
| | 1983 | 51,436 | 498,047 | 490,568 | 306,666 | 1,346,717 | 703,112 | 2,724,493 |
| | 1982 | 13,429 | 375,281 | 176,287 | 58,733 | 623,730 | 615,160 | 833,546 |
| | 1981 | 5,948 | 344,374 | 358,072 | 74,415 | 782,809 | 693,945 | 1,573,759 |

*1981-1982 by calendar year. 1983-90 based on FERC construction-permit applications, for 12-month period ending June 30 of that year. † One report only. § Involves a river crossing.

## Current compressor-station costs

| Location* | Horsepower | Equipment & material | Labor | Land | Misc.† | Total | $/hp |
|---|---|---|---|---|---|---|---|
| | | $ | | | | | |
| Ohio | 800 | 1,090,000 | 757,000 | 80,000 | 323,695 | 2,250,695 | 2,813 |
| New York† | 1,000 | 889,700 | 664,600 | 2,800 | 626,331 | 2,183,431 | 2,183 |
| Ohio† | 1,200 | 1,602,000 | 1,181,000 | 298,000 | 420,884 | 3,501,884 | 2,918 |
| Massachusetts† | 1,200 | 2,080,300 | 1,650,000 | 369,300 | 1,360,210 | 5,459,810 | 4,550 |
| Massachusetts† | 1,200 | 2,080,300 | 1,650,000 | 369,300 | 1,361,111 | 5,460,711 | 4,551 |
| Pennsylvania† | 1,350 | 1,045,000 | 420,000 | – | 203,920 | 1,668,920 | 1,236 |
| Tennessee† | 1,360 | 958,900 | 650,000 | – | 453,700 | 2,062,600 | 1,517 |
| Tennessee† | 1,360 | 1,144,000 | 650,000 | – | 509,700 | 2,303,700 | 1,694 |
| Tennessee† | 1,360 | 1,144,000 | 650,000 | – | 509,700 | 2,303,700 | 1,694 |
| Tennessee† | 1,360 | 1,144,000 | 650,000 | – | 509,800 | 2,303,800 | 1,694 |
| Massachusetts† | 1,600 | 1,382,700 | 1,305,700 | 5,100 | 896,071 | 3,589,571 | 2,243 |
| Massachusetts† | 1,850 | 1,598,400 | 1,509,100 | 6,300 | 1,035,000 | 4,148,800 | 2,243 |
| Iowa | 2,000 | 2,104,071 | 542,817 | 10,000 | 1,031,484 | 3,688,372 | 1,844 |
| New York† | 2,100 | 2,951,500 | 2,063,400 | 11,500 | 2,266,070 | 7,292,470 | 3,473 |
| Tennessee† | 2,720 | 2,082,000 | 1,250,000 | – | 835,300 | 4,167,300 | 1,532 |
| Maryland† | 3,200 | 2,900,000 | 1,378,000 | – | 625,256 | 4,903,256 | 1,532 |
| Maryland† | 3,200 | 3,170,000 | 1,538,000 | – | 695,759 | 5,403,759 | 1,689 |
| Maryland | 3,200 | 4,400,000 | 2,418,000 | – | 1,288,366 | 8,106,366 | 2,533 |
| New York | 3,500 | 3,118,300 | 2,329,600 | 9,800 | 2,195,260 | 7,652,960 | 2,187 |
| Massachusetts† | 3,700 | 3,026,900 | 2,145,900 | 18,600 | 2,166,951 | 7,358,351 | 1,989 |
| West Virginia† | 4,000 | 3,850,000 | 1,734,000 | – | 913,922 | 6,497,922 | 1,624 |
| Pennsylvania† | 4,000 | 3,812,000 | 1,800,000 | – | 888,182 | 6,500,182 | 1,625 |
| Iowa | 4,000 | 4,140,005 | 1,031,665 | 75,000 | 1,565,271 | 6,811,941 | 1,703 |
| Virginia† | 4,390 | 2,900,000 | 994,000 | – | 508,753 | 4,402,753 | 1,003 |
| Arizona | 5,300 | 2,490,000 | 1,625,000 | 35,000 | 632,169 | 4,782,169 | 902 |
| Arizona | 5,300 | 2,807,000 | 1,715,000 | 35,000 | 670,048 | 5,227,048 | 986 |
| Arizona | 5,300 | 2,807,000 | 1,715,000 | 35,000 | 1,101,356 | 5,658,356 | 1,094 |
| Arizona | 5,300 | 3,145,000 | 1,851,000 | 35,000 | 767,632 | 5,798,632 | 1,094 |
| Arizona | 5,300 | 3,145,000 | 1,851,000 | 35,000 | 1,246,220 | 6,277,220 | 1,184 |
| Wyoming-California | 5,300 | 3,429,000 | 1,887,000 | – | 1,234,000 | 6,550,000 | 1,236 |
| Virginia | 5,300 | 3,713,000 | 1,388,000 | 42,000 | 1,743,748 | 6,886,748 | 1,299 |
| Arizona | 5,300 | 2,807,000 | 1,715,000 | 35,000 | 2,629,694 | 7,186,694 | 1,356 |
| Arizona | 5,300 | 3,145,000 | 1,851,000 | 35,000 | 2,946,372 | 7,977,372 | 1,505 |
| Rhode Island† | 5,500 | 3,425,000 | 4,145,000 | 50,000 | 668,846 | 8,288,846 | 1,507 |
| Virginia | 6,000 | 3,601,000 | 1,210,400 | – | 1,444,179 | 6,255,579 | 1,043 |
| Virginia | 6,000 | 3,876,000 | 1,340,400 | – | 1,364,389 | 6,580,789 | 1,097 |
| Colorado | 6,000 | 4,389,000 | 2,233,000 | 80,000 | 1,473,863 | 8,175,863 | 1,363 |
| Pennsylvania | 6,500 | 6,396,000 | 2,971,000 | 20,000 | 1,912,549 | 11,299,549 | 1,738 |
| Pennsylvania | 6,500 | 6,633,000 | 3,046,000 | 20,000 | 1,945,220 | 11,644,220 | 1,791 |
| Virginia | 7,660 | 4,562,000 | 1,488,000 | – | 1,217,541 | 7,267,541 | 949 |
| Colorado† | 8,000 | 5,593,000 | 1,635,000 | 27,000 | 1,496,151 | 8,751,151 | 1,094 |
| Utah | 9,200 | 6,135,700 | 3,745,500 | 191,000 | 2,385,599 | 12,457,799 | 1,354 |
| Nevada | 9,400 | 6,088,300 | 4,467,500 | 191,000 | 2,533,046 | 13,279,846 | 1,413 |
| Virginia | 9,600 | 9,600,000 | 3,893,000 | – | 1,909,495 | 15,402,495 | 1,604 |
| Pennsylvania | 11,000 | 5,843,000 | 3,777,000 | 30,000 | 2,806,459 | 12,456,459 | 1,132 |
| Pennsylvania | 11,000 | 6,982,000 | 4,635,000 | 30,000 | 3,640,142 | 15,287,142 | 1,390 |
| Arizona | 12,000 | 4,971,000 | 2,646,000 | 35,000 | 4,420,113 | 12,072,113 | 1,006 |
| Colorado | 12,000 | 4,342,000 | 2,391,000 | 35,000 | 1,145,470 | 8,413,470 | 701 |
| Arizona | 12,000 | 4,612,000 | 2,209,000 | 35,000 | 1,655,106 | 8,511,106 | 709 |
| Arizona | 12,000 | 4,971,000 | 2,646,000 | 35,000 | 1,126,344 | 8,778,344 | 732 |
| Arizona | 12,000 | 4,971,000 | 2,646,000 | 35,000 | 1,847,118 | 9,499,118 | 792 |
| Colorado | 12,600 | 4,842,000 | 2,391,000 | 35,000 | 1,136,579 | 8,404,579 | 667 |
| Montana | 12,600 | 4,930,000 | 4,075,000 | 166,648 | 2,670,837 | 11,842,485 | 940 |
| Montana | 12,600 | 4,930,000 | 4,075,000 | 166,648 | 2,670,837 | 11,842,485 | 940 |
| Wyoming | 12,600 | 4,930,000 | 3,893,000 | 163,870 | 2,630,890 | 11,617,760 | 922 |
| Wyoming | 12,600 | 4,930,000 | 3,893,000 | 163,870 | 2,630,890 | 11,617,760 | 922 |
| Wyoming | 12,600 | 4,930,000 | 3,893,000 | 163,870 | 2,630,890 | 11,617,760 | 922 |
| Wyoming | 12,600 | 6,769,800 | 3,066,800 | 22,500 | 2,535,360 | 12,394,460 | 984 |
| Montana | 12,600 | 6,769,800 | 3,361,800 | 62,500 | 2,360,851 | 12,554,951 | 996 |
| Wyoming | 12,600 | 6,878,000 | 3,081,100 | 22,500 | 2,917,830 | 12,899,430 | 1,024 |
| Montana | 12,600 | 6,802,800 | 3,376,100 | 62,500 | 2,722,460 | 12,963,860 | 1,029 |
| New York† | 12,600 | 6,935,000 | 5,320,000 | 125,000 | 1,088,929 | 13,468,929 | 1,069 |
| Wyoming | 12,600 | 7,645,500 | 3,442,000 | 22,500 | 2,948,560 | 14,058,560 | 1,116 |
| New York† | 12,600 | 7,415,000 | 5,875,000 | 235,000 | 1,186,721 | 14,711,721 | 1,168 |
| Montana | 12,600 | 18,575,000 | 12,460,000 | 566,602 | 8,634,245 | 40,255,847 | 3,195 |
| Arizona | 14,080 | 14,111,400 | 4,100,300 | 60,000 | 4,849,348 | 23,121,048 | 1,642 |
| Wyoming-California | 15,900 | 7,691,000 | 3,043,000 | – | 2,491,000 | 13,225,000 | 832 |
| Wyoming-California | 15,900 | 7,691,000 | 3,043,000 | – | 2,491,000 | 13,225,000 | 832 |
| Washington† | 16,481 | 10,904,000 | 1,211,000 | – | 3,496,716 | 15,611,716 | 947 |
| Texas | 16,560 | 16,015,000 | 3,209,000 | 58,000 | 3,455,000 | 22,737,000 | 1,373 |
| Wyoming | 17,100 | 11,613,300 | 5,938,400 | 181,000 | 4,206,710 | 21,939,410 | 1,283 |
| Oregon† | 17,207 | 11,132,000 | 1,221,000 | – | 3,554,264 | 15,907,264 | 924 |
| Arizona | 17,300 | 7,246,000 | 2,881,000 | 70,000 | 2,454,728 | 12,651,728 | 731 |
| Wyoming-California | 21,200 | 9,822,000 | 3,621,000 | – | 3,120,000 | 16,563,000 | 781 |
| Michigan-Wisconsin | 27,000 | 65,995,000 | 19,415,200 | – | 21,948,996 | 106,359,196 | 3,939 |
| Washington† | 27,097 | 12,155,000 | 1,942,000 | – | 4,496,991 | 18,593,991 | 686 |
| Montana | 50,400 | 26,208,400 | 9,689,100 | 32,500 | 9,085,010 | 45,015,010 | 893 |
| Montana-Illinois | 140,000 | 57,830,000 | 25,829,000 | 4,582,269 | 24,758,130 | 112,999,399 | 807 |
| **Total—land projects** | **838,335** | **534,290,076** | **245,051,382** | **9,319,477** | **200,327,337** | **988,988,272** | **1,180** |
| 1989—report total land projects | 345,800 | 215,519,908 | 96,946,576 | 6,415,185 | 68,306,188 | 387,187,857 | 1,120 |
| **Total—all projects** | **838,335** | **534,290,076** | **245,051,382** | **9,319,477** | **200,327,337** | **988,988,272** | **1,180** |

Source: U.S. FERC construction-permit applications, July 1, 1989, to June 30, 1990. * Generally includes engineering, supervision, interest, administration & overheads, contingencies, Afudc, and FERC fees. † Additions.

suggests the growing strengths of natural gas in commercial, residential, and power generation use.

In addition, compressed natural gas (CNG) is being touted as an alternative fuel for fleets.

### Cost trends, components

Cost-per-mile figures may reveal more about cost trends than aggregate costs.

For proposed U.S. gas-pipeline projects in the 1989-90 period surveyed, the average land cost per mile was

## Natural-gas pipeline transmission expenses*

| | Expenses, $ | | Cost/mile, $ | | [illegible] | |
|---|---|---|---|---|---|---|
| | 1987-majors† | 1988-majors§ | 1987-majors† | 1988-majors§ | 1987-majors† | 1988-majors§ |
| **Operation expenses** | | | | | | |
| Supervision and engineering | 151,879,238 | 168,584,029 | 610.46 | 661.37 | [illegible] | [illegible] |
| System control and load dispatching | 26,858,420 | 29,284,519 | 108.10 | 115.26 | [illegible] | [illegible] |
| Communication system expenses | 29,310,758 | 30,224,686 | 117.97 | 120.00 | [illegible] | [illegible] |
| Compressor station labor and expenses | 251,661,867 | 269,976,244 | 1,012.88 | 1,071.36 | [illegible] | [illegible] |
| Gas for compressor station fuel | 367,406,730 | 375,892,248 | 1,478.75 | 1,492.38 | [illegible] | [illegible] |
| Other fuel and power for compressor stations | 63,842,107 | 65,481,393 | 256.95 | 259.97 | [illegible] | [illegible] |
| Mains | 168,358,688 | 182,168,091 | 677.61 | 723.29 | [illegible] | [illegible] |
| Measuring and regulating station expenses | 61,623,174 | 61,872,085 | 248.02 | 245.64 | [illegible] | [illegible] |
| Transmission and compression of gas by others | 1,049,122,569 | 936,299,992 | 4,222.63 | 3,717.29 | [illegible] | [illegible] |
| Other transmission expenses | 38,278,436 | 40,409,766 | 154.06 | 160.43 | [illegible] | [illegible] |
| Rents | 18,421,763 | 19,796,436 | 74.14 | 78.60 | [illegible] | [illegible] |
| **Total operation expenses** | **2,226,553,750** | **2,177,988,127** | **8,961.49** | **8,657.00** | **344.19** | [illegible] |
| **Maintenance expenses** | | | | | | |
| Supervision and engineering | 34,596,228 | 31,519,887 | 139.24 | 125.14 | [illegible] | [illegible] |
| Structures and improvements | 21,181,592 | 22,517,885 | 85.25 | 89.40 | [illegible] | [illegible] |
| Mains | 91,003,249 | 109,462,229 | 366.27 | 434.58 | [illegible] | [illegible] |
| Compressor station equipment | 197,326,728 | 218,175,493 | 749.21 | 866.20 | [illegible] | [illegible] |
| Measuring and regulating station equipment | 12,117,702 | 13,202,645 | 48.77 | 52.42 | [illegible] | [illegible] |
| Communication equipment | 12,077,950 | 11,906,439 | 48.61 | 47.27 | [illegible] | [illegible] |
| Other equipment | 3,259,046 | 4,036,815 | 13.12 | 16.05 | [illegible] | [illegible] |
| **Total maintenance expenses** | **371,562,495** | **41[illegible],821,393** | **1,495.47** | **1,651.03** | **57.44** | [illegible] |
| **Total transmission expenses** | **$2,598,116,245** | **2,5[illegible],809,520** | **10,456.96** | **10,278.03** | [illegible] | [illegible] |
| **Total miles of transmission pipeline** | **248,458** | **251,878** | | | | |
| **Total natural gas sold, MMcf** | **6,468,964** | **[illegible]368,682** | | | | |

* U.S. interstate pipelines for calendar years 1987 & 1988. † 43 of 126 companies filing Form 2's or 2A's with the U.S. FERC for 1987; [illegible] sold for resale and gas transported or stored for a fee exceed 50 bcf (at 14.7 psi; 60° F.) in each of the 3 previous calendar years. §46 of 131 [illegible] U.S. FERC for 1988; majors defined in previous note and in U.S. FERC Accounting and Reporting Requirements for Natural Gas Companies, para. 20,011, [illegible] beginning with the 1984 reporting year (OGJ, Nov. 25, 1985, p. 80).
Source: Statistics of Interstate Natural Gas Pipeline Companies—1987 & 1988, U.S. Department of Energy.

$830,882/mile compared with $842,050/mile for the 1988-89 period, a slight decrease.

For offshore projects, the 1989-90 figure was $834,057, compared with the 1988-89 figure of $737,474, an increase of 13.1%

Combined land and offshore projects show an average cost of $830,908/mile for this year's coverage; for the 1988-89 period, the figure was $825,278/mile.

Analyses of the four major categories of pipeline construction costs—material, labor, right-of-way, and miscellaneous—can also indicate trends within each group.

"Right-of-way" figures include the costs of obtaining right-of-way and of any surveying along with allowance for damages.

"Miscellaneous" generally includes engineering, supervision, contingencies, allowances for funds used during construction (afudc), administration and overheads, and FERC filing fees.

For the 171 projects surveyed for the 1989-90 period covered in this report, cost-per-mile data for the four categories are as follows:

- Material—Land, $342,912/mile; offshore, $345,566/mile; total, $342,934/mile.
- Labor—Land, $298,043/mile; offshore, $283,654/mile; total, $297,925/mile.
- R.O.W. and damages—Land, $159,081/mile; offshore, $18,295/mile; total, $159,305/mile.
- Miscellaneous—Land, $30,846/mile; offshore, $18,543/mile; total, $30,744/mile.

Table 2 lists proposed pipelines in order of increasing diameter and increasing lengths within each pipeline diameter. The average cost per mile for the projects shows no clear-cut trend related to either length or geographic area.

In general, however, the cost per mile within a given diameter indicates that the longer the pipeline, the lower the incremental cost for construction.

Nonetheless, road, highway, and river crossings and marshy or rocky terrain each strongly affects pipeline construction costs.

Fig. 3, derived from Table 2 for land and offshore pipelines, shows the major cost-component split for pipeline construction costs.

Material and labor are shown to make up almost 78% of the cost of constructing land pipelines and almost 76% of the cost for offshore pipelines.

Fig. 4 plots the average pipeline construction cost for land and offshore gas-pipeline construction projects listed in Table 2.

### Compressor stations

Compressor-station costs make up another major cost element of natural-gas pipelines. Table 6 lists 78 land compressor-station projects. FERC applications for these projects cover the same period as for pipelines: July 1, 1989, to June 30.

Costs for new land compressor stations range from a low of $667/hp for a 12,600-hp station in Colorado to a high of $4,551/hp for a 1,200-hp station in Massachusetts. Cost-per-horsepower figures show no particular correlation with compressor-station size or location.

Fig. 5 shows the cost split for land compressor stations based on data in Table 6.

### Effect of size

Another element affecting the capital expenditures for pipeline construction is the distribution of the diameter and mileage.

Fig. 6's curves reflect the cumulative percentage of mileage for pipeline diameters of 2 in. to 48 in. for July 1, 1988, to June 30, 1989, and for 8 in. to 42 in. for July 1, 1989, to June 30.

As an aid in determining the detailed costs for each major element in pipeline and compressor-station construction for the pipelines and compressor stations, several tables covering specific projects are included in this report.

These give detailed cost

## A LOOK AT VARIOUS PROJECTS

### 4.25 miles of 36 in. replacement, Pennsylvania

| Item | Cost |
|---|---|
| Route, environmental survey | 55,000 |
| Right-of-way, damages, permits | 445,000 |
| Pipe | 1,615,000 |
| Coating | 204,000 |
| Other material | 279,000 |
| Contract installation | 3,742,000 |
| Company installation | 543,000 |
| Contingency | 324,000 |
| Miscellaneous—general plant, fee, line pack | 607,292 |
| **Total** | **7,814,292** |
| **$/mile** | **1,838,657** |

### 8.22 miles of 36 in., loop Pennsylvania

| Item | Cost |
|---|---|
| Rights-of-way, damages | 263,300 |
| Surveys | 123,300 |
| Line pipe | |
| 0.462-in. W.T. X65 | 1,239,334 |
| 0.554-in. W.T. X65 | 1,107,216 |
| 0.750-in. W.T. X65 | 193,986 |
| Internal coatings | 121,128 |
| External coatings | 377,640 |
| Valves, fittings | 524,750 |
| Rock shield | 115,000 |
| Freight | 205,130 |
| Miscellaneous materials | 306,039 |
| Installation—36 in. line | 3,376,600 |
| Bored crossings | 204,000 |
| Other installations | 1,206,346 |
| Field engineering, supervision | 316,231 |
| Miscellaneous | 1,663,104 |
| **Total** | **11,343,104** |
| **$/mile** | **1,379,940** |

### 27 miles of 24 in., Virginia

| Item | Cost |
|---|---|
| Right-of-way, damages | 4,573,600 |
| Line pipe valves, fittings | 13,733,400 |
| Cathodic protection | 213,700 |
| River crossings | 227,500 |
| Road, railroad crossing | 836,400 |
| X-ray inspection | 293,400 |
| Seed, fertilizer, mulch | 307,300 |
| Engineering, surveying, inspection | 672,300 |
| Archaeological, environmental studies | 193,700 |
| Gas lost in construction and line pack | 188,500 |
| Contingency | 1,062,000 |
| Afudc | 1,023,200 |
| FERC fee (est.) | 15,584 |
| **Total** | **23,340,584** |
| **$/mile** | **864,466** |

### 2.19 miles of 16 in., Alabama

| Item | Cost |
|---|---|
| Right-of-way | 38,500 |
| Pipe | |
| 16 in. OD, 0.250-in. W.T. 5L X 60 | 164,900 |
| 16 in. OD, 0.344-in. W.T., 5L X 42 | 29,700 |
| Coating material—enamel | 57,800 |
| Meter, regulator facilities | 192,600 |
| Miscellaneous materials | 139,500 |
| Installation | 461,900 |
| Engineering—surveying, mapping | 6,300 |
| Administrative & field engineering, inspection | 111,100 |
| General overhead | 55,000 |
| Interest | 25,800 |
| FERC fee (est.) | 4,575 |
| **Total** | **1,307,675** |
| **$/mile** | **597,112** |

### 16.68 miles of 30 in., Alabama

| Item | Cost |
|---|---|
| Right-of-way | 169,000 |
| Surveys | 467,000 |
| Materials | 6,365,000 |
| Labor | 6,513,000 |
| Engineering, inspection | 439,000 |
| Line pack | 71,000 |
| Overheads | 1,013,000 |
| Afudc | 606,000 |
| Contingencies | 699,000 |
| Other services, costs | 49,000 |
| Regulatory fees | 26,280 |
| **Total** | **16,437,280** |
| **$/mile** | **985,448** |

### 4.47 miles of 12 in., New Hampshire

| Item | Cost |
|---|---|
| Right-of-way | 305,200 |
| Surveys | 21,900 |
| Materials | 612,900 |
| Labor | 1,279,300 |
| Engineering, inspection | 267,200 |
| Line pack | 3,400 |
| Freight | 32,200 |
| Pipe coating | 46,700 |
| Overheads | 161,800 |
| Afudc | 171,540 |
| Contingencies | 128,400 |
| Regulatory fees | 740 |
| **Total** | **3,031,280** |
| **$/mile** | **678,139** |

### 2.31 miles of 10 in., Rhode Island

| Item | Cost |
|---|---|
| Right-of-way | 238,900 |
| Surveys | 27,600 |
| Materials | 296,600 |
| Labor | 677,200 |
| Engineering, inspection | 231,800 |
| Line pack | 1,100 |
| Taxes | 19,000 |
| Freight | 13,600 |
| Pipe coating | 20,200 |
| Overheads | 95,700 |
| Afudc | 101,860 |
| Contingencies | 76,300 |
| Regulatory fees | 440 |
| **Total** | **1,800,320** |
| **$/mile** | **779,359** |

### 17 miles of 24 in., Arizona-California

| Item | Cost |
|---|---|
| Right-of-way, (est.) | 112,725 |
| Pipe | |
| 0.241-in. W.T. 5L X 70, 15 miles | 1,768,100 |
| 0.289-in. W.T., 5L X 70, 1.7 miles | 239,800 |
| 0.347-in. W.T., 5L X 70, 0.3 miles | 50,700 |
| Freight | 155,700 |
| Stockpiling | 72,300 |
| Coating—internal, external | 252,800 |
| Shrink sleeves | 63,000 |
| Tax (pipe, coating, sleeves) | 142,500 |
| Casing—30 in., 0.5 in., 320 ft | 15,100 |
| Tax (casing pipe) | 900 |
| Concrete weights | 39,400 |
| Pig launcher assembly | 25,000 |
| Pig receiver assembly | 25,000 |
| Main line valves | 74,100 |
| 20-in. valves | 40,000 |
| Miscellaneous materials | 61,400 |
| Tax (materials) | 15,900 |
| Labor | 2,479,440 |
| Miscellaneous | 3,591,710 |
| **Total** | **9,225,575** |
| **$/mile** | **542,681** |

breakdowns for each major component in a construction-cost estimate.

They cover cost information from the FERC applications for the 1989-90 period surveyed and listed in Table 3.

These detailed tables represent both a variety of land geographic locations in the U.S. and pipeline and compressor stations for both land and offshore facilities.

#### Operating costs

Once a natural-gas pipeline is laid and compressor stations constructed, operating costs become the next consideration.

As an aid in estimating this element, transmission expenses for interstate gas pipelines for 1987 and 1988 have been included (Table 7).

Its data are based on 248,458 miles of pipeline operated and 6.5 tcf of gas sold for 1987 majors and on 251,878 miles of pipeline operated and 6.4 tcf of gas sold for 1988 majors.

- The highest component of transmission-operating expenses is transmission and compression of gas by others: for majors in 1987, this component was $4,222/mile or $162/MMcf; for majors in 1988, this component was $3,717/mile or $147/MMcf.
- The second highest cost component of transmission-operating expense is gas for compressor-station fuel: for majors in 1987, $1,479/mile or $57/MMcf; for majors in 1988, $1,492/mile or $59/MMcf.
- The highest cost component of maintenance expense covers compressor-station

### 121.5 miles of 42 in., Arizona-California

| Item | Cost |
|---|---|
| Right-of-way (est.) | 4,815,965 |
| Pipe | |
| 0.500-in. W.T. 5L X 70, 111.5 miles | 47,628,300 |
| 0.600-in. W.T., 5L X 70, 10 miles | 5,113,600 |
| Freight | 2,465,200 |
| Stockpiling | 452,600 |
| Coating—internal, external | 6,800,100 |
| Shrink sleeves | 517,400 |
| Tax (pipe, coating, sleeves) | 3,603,600 |
| Casing, 48 in., 0.5 in., 1,600 ft | 121,800 |
| Tax (casing pipe) | 7,300 |
| Concrete weights | 441,000 |
| Pig launcher assembly | 47,300 |
| Pig receiver assembly | 47,300 |
| Main line valves | 816,300 |
| 36-in. valves | 109,000 |
| Miscellaneous materials | 838,400 |
| Tax (materials) | 138,000 |
| Labor | 38,486,241 |
| Miscellaneous | 27,996,030 |
| **Total** | **140,445,436** |
| **$/mile** | **1,155,930** |

### 134.3 miles of 42 in., Idaho-California

| Item | Cost |
|---|---|
| Right-of-way | 528,135 |
| Mainline coated pipe | 57,171,000 |
| Valves | 1,924,000 |
| Misc. pipe, fittings | 503,000 |
| Casing | 62,000 |
| Valve shelters, pipeline markers, misc. | 137,000 |
| Mainline pipe inland freight | 6,957,000 |
| Other pipe inland freight | 8,000 |
| Mainline construction contract | 58,399,000 |
| Other contracts | 431,000 |
| Survey contract | 135,000 |
| Radiographic contract | 604,000 |
| Property damage payments | 709,000 |
| Restoration | 2,087,000 |
| Line pack | 728,000 |
| Blow gas | 218,000 |
| Misc. | 41,103,024 |
| **Total** | **171,704,159** |
| **$/mile** | **1,278,512** |

### 25.4 miles of 30 in., Alabama

| Item | Cost |
|---|---|
| Right-of-way | 623,200 |
| Pipe | |
| 30 in. OD, 0.328-in. W.T. 5L X 65 | 5,429,800 |
| 30 in. OD, 0.406-in. W.T., 5L X 65 | 426,200 |
| 30 in. OD, 0.500-in. W.T., 5L X 60 | 226,200 |
| Coating material—enamel | 798,500 |
| Meter, regulator facilities | 647,900 |
| Miscellaneous materials | 1,645,700 |
| Installation | 5,241,700 |
| Engineering—surveying, mapping | 72,800 |
| Administrative & field engineering, inspection | 1,738,900 |
| General overhead | 758,300 |
| Interest | 1,065,400 |
| FERC fee (est.) | 65,475 |
| **Total** | **18,740,075** |
| **$/mile** | **737,798** |

### 6.13 miles of 12 in., Massachusetts

| Item | Cost |
|---|---|
| Right-of-way | 400,400 |
| Surveys | 35,600 |
| Materials | 792,700 |
| Labor | 1,513,800 |
| Engineering, inspection | 456,800 |
| Line pack | 4,000 |
| Freight | 44,200 |
| Pipe coating | 64,200 |
| Overheads | 208,700 |
| Afudc | 221,160 |
| Contingencies | 165,600 |
| Regulatory fees | 960 |
| **Total** | **3,908,120** |
| **$/mile** | **637,540** |

### Install 3,200 hp, Maryland

| Item | Cost |
|---|---|
| Materials | 4,400,000 |
| Installation costs | 2,418,000 |
| Other costs | 488,000 |
| Afudc | 303,600 |
| General administration | 410,600 |
| Construction overheads | 78,300 |
| Misc. | 7,866 |
| **Total** | **8,106,366** |
| **$/hp** | **2,533** |

### 10.42 miles of 30 in., Alabama, offshore

| Item | Cost |
|---|---|
| Right-of-way | 26,955 |
| Surveys | 291,760 |
| Materials | 4,654,207 |
| Labor | 3,260,316 |
| Engineering, inspection | 288,170 |
| Line pack | 46,481 |
| Overheads | 617,803 |
| Afudc | 369,863 |
| Contingencies | 426,070 |
| Other services, costs | 29,825 |
| **Total** | **10,011,450** |
| **$/mile** | **960,792** |

### 49.66 miles of 24 in., Alabama, offshore

| Item | Cost |
|---|---|
| Right-of-way | 845 |
| Surveys | 794,490 |
| Materials | 16,107,389 |
| Labor | 13,781,609 |
| Engineering, inspection | 1,073,625 |
| Line pack | 170,417 |
| Overheads | 5,477,762 |
| Afudc | 2,067,224 |
| Contingencies | 1,587,698 |
| Other services, costs | 111,258 |
| **Total** | **41,172,317** |
| **$/mile** | **829,084** |

### Install 12,000 hp, Colorado

| Item | Cost |
|---|---|
| Site improvements | 35,000 |
| Compressor building | 67,000 |
| Foundations | 32,000 |
| Gas turbine | 3,210,000 |
| Gas cooling | 252,000 |
| Scrubber | 84,000 |
| Accessory equipment | 74,000 |
| Piping | 439,000 |
| Electrical | 166,000 |
| Instrumentation, controls | 250,000 |
| Other material | 268,000 |
| Installation | |
| Company | 120,000 |
| Contract | 2,271,000 |
| Other field costs | 412,000 |
| Misc. | 733,470 |
| **Total** | **8,413,470** |
| **$/hp** | **701** |

### 142 miles of 30 in., Arizona-California

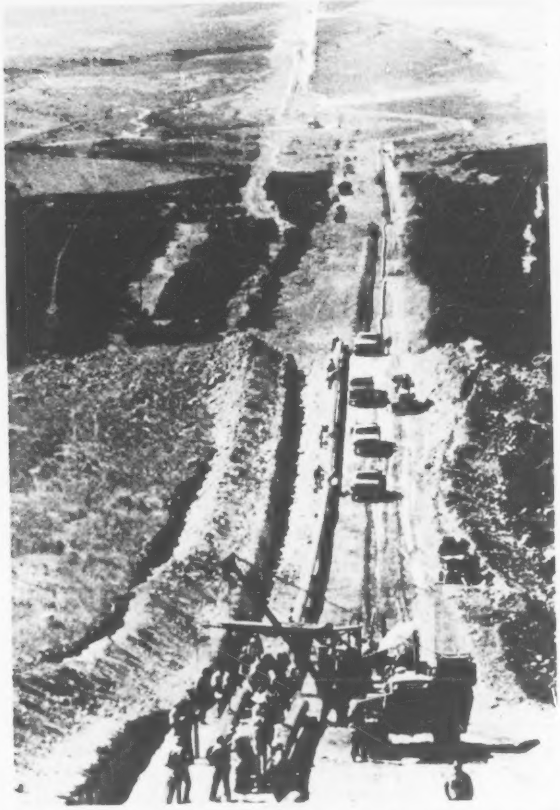
| Item | Cost |
|---|---|
| Right-of-way, (est.) | 940,776 |
| Pipe | |
| 0.358-in. W.T. 5L X 70, 131.5 miles | 27,546,300 |
| 0.430-in. W.T., 5L X 70, 10.5 miles | 2,635,500 |
| Freight | 1,652,900 |
| Stockpiling | 296,800 |
| Coating—internal, external | 5,848,100 |
| Shrink sleeves | 454,200 |
| Tax (pipe, coating, sleeves) | 2,189,000 |
| Casing—36 in., 0.5 in., 1,300 ft | 73,900 |
| Tax (casing pipe) | 4,400 |
| Concrete weights | 270,000 |
| Pig launcher assembly | 60,000 |
| Pig receiver assembly | 60,000 |
| Main line valves | 398,200 |
| 24-in. valves | 98,800 |
| Miscellaneous materials | 627,600 |
| Tax (materials) | 90,900 |
| Labor | 27,566,160 |
| Miscellaneous | 15,055,069 |
| **Total** | **85,868,605** |
| **$/mile** | **604,706** |

### Add 1,200 hp, Ohio

| Item | Cost |
|---|---|
| Materials | 1,602,000 |
| Installation costs | 1,181,000 |
| Land | 29,800 |
| Other costs | 116,500 |
| Afudc | 120,300 |
| General administration | 124,600 |
| Construction overheads | 56,100 |
| Misc. | 3,384 |
| **Total** | **3,501,884** |
| **$/hp** | **2,918** |

### Add 4,390 hp, Virginia

| Item | Cost |
|---|---|
| Materials | 2,900,000 |
| Installation costs | 994,000 |
| Other costs | 171,000 |
| Afudc | 118,600 |
| General administration | 157,900 |
| Construction overheads | 57,000 |
| Misc. | 4,253 |
| **Total** | **4,402,753** |
| **$/hp** | **1,003** |



**CONSTRUCTION of Questar Pipeline Co.'s north-south crossover proceeds near Vernal, Utah, during summer construction. The line runs from the company's Fidlar compressor station on its southern segment to the Clay basin storage area near the Wyoming border on the northern segment of the system.**

equipment: for majors in 1987, $794/mile or $30/MMcf; for majors in 1988, $866/mile or $34/MMcf.

- The second highest cost component for maintenance is the maintenance of pipelines: for majors in 1987, $366/mile or $14/MMcf; for 1988 majors, $435/mile or $17/MMcf.
- Table 7 indicates that the highest component of transmission expenses for natural-gas pipelines is the operation expense: for 1987 majors, $8,961/mile or 344/MMcf; for 1988 majors, $8,647/mile or $342/MMcf.
- Unit-maintenance expenses for 1987 majors were $1,495/mile or $57/MMcf; for 1988 majors, $1,631/mile or $64/MMcf.
- During 1987, major natural-gas pipeline companies spent slightly more than $2.2 billion for operation expenses and $371.6 million on maintenance. Total expenditures by 1987 majors for operation and maintenance reached almost $2.6 billion.

Total operation expenses for majors in 1988 fell to slightly less than 2.2 billion, a drop of almost $48.6 million (−2.2%). This follows a sharp drop of 14.3% from 1986 to 1987 noted in last year's report.

Total maintenance expenses in 1988 rose to slightly more than $410 million from a 1987 cost of $371 million.

Total transmission expenses showed a slight decline between 1987 and 1988.

In the latter year, they reached $2.588 billion.

- On a unit basis, the total 1987 transmission expense for majors was $10,457/mile or $402/MMcf; for 1988, $10,278/mile or $407/MMcf of gas sold. ▪

## LIQUID PIPELINES

| COMPANY | Miles of pipeline |  |  |  | Deliveries, 1,000 bbl |  |  | Total trunkline traffic, million bbl-miles |  |  | Fiscal data, $1,000 |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Gathering | Trunk Crude | Trunk Products | Total | Crude | Products | Total | Crude | Products | Total | Carrier property | Change | Operating revenue | Income |
| Airforce Pipeline Inc. | — | — | 5 | 5 | — | 1,528 | 1,528 | — | 8 | 8 | 353 | — | 271 | 57 |
| Algonquin Pipe Line Co. | 23 | 51 | — | 74 | 573 | — | 573 | 20 | — | 20 | 2,137 | (224) | 474 | (36) |
| All American Pipeline Co. | — | 1,108 | — | 1,108 | 34,551 | — | 34,551 | 38,283 | — | 38,283 | 1,482,016 | (57,787) | — | (55,901) |
| Allegheny Pipeline Co. | — | — | 603 | 603 | — | 9,840 | 9,840 | — | 3,034 | 3,034 | 18,335 | 524 | 4,380 | 1,077 |
| Amerada Hess Pipeline Co. | — | *818 | — | *818 | 10,530 | — | 10,530 | 7,640 | — | 7,640 | 150,243 | 635 | 31,180 | 9,572 |
| American Petrofina Pipeline Co. | — | 1,104 | — | 1,104 | 28,086 | — | 28,086 | 969 | — | 969 | 32,490 | 6,857 | 7,528 | (818) |
| Amoco Pipeline Co. | 2,218 | 7,637 | 2,298 | 12,153 | 324,832 | 151,664 | 476,496 | 109,642 | 10,845 | 120,487 | 613,713 | 28,872 | 202,112 | 91,611 |
| Antelope Pipe Line Co. | — | — | — | — | 825 | — | 825 | 64 | — | 64 | 2 | 2 | 227 | (17) |
| ARCO Pipe Line Co. | 1,611 | *2,402 | 2,837 | *6,850 | 407,677 | 96.307 | 503,984 | 148,823 | 9,320 | 158,143 | 2,383,047 | 3,335 | 550,053 | 198,389 |
| Ashland Pipe Line Co. | 502 | 787 | — | 1,289 | 93,102 | — | 93,102 | 63,084 | — | 63,084 | 104,429 | 4,068 | 41,847 | 28,575 |
| Atlantic Pipeline Co. | — | 11 | 929 | 940 | 49,331 | 49,617 | 98,948 | — | 7,867 | 7,867 | 65,221 | 12,122 | 35,702 | 9,758 |
| Attco NGL Pipeline Co. | — | — | 27 | 27 | — | 154 | 154 | — | 4 | 4 | 225 | — | 35 | (44) |
| Badger Pipe Line Co. | — | — | 334 | 334 | — | 65,463 | 65,463 | — | 3,864 | 3,864 | 25,966 | 281 | 12,580 | 3,598 |
| Belle Fourche Pipeline Co. | 1,261 | 729 | — | 1,990 | 27,763 | — | 27,763 | 2,838 | — | 2,838 | 58,253 | (148) | 15,238 | 6,063 |
| Black Lake Pipe Line Co. | — | — | 255 | 255 | — | 2,790 | 2,790 | — | 477 | 477 | 10,552 | (2) | 1,857 | 266 |
| BP Oil Pipeline Co.† | 1,089 | 550 | 278 | 1,917 | 171,972 | 105,365 | 277,337 | 50,243 | 12,451 | 62,694 | 110,507 | 2,455 | 83,627 | 13,848 |
| BP Pipeline (Alaska) Inc.§ | — | *818 | — | *818 | 351,504 | — | 351,504 | 268,211 | — | 268,211 | 4,923,627 | 21,107 | 1,018,090 | 342,476 |
| Buccaneer Pipe Line Co. | — | 2 | — | 2 | 233 | — | 233 | — | — | — | 176 | — | 35 | (147) |
| Buckeye Pipe Line Co. L. P. | — | — | 3,390 | 3,390 | — | 285,608 | 285,608 | — | 36,004 | 36,004 | 474,163 | 5,348 | 136,893 | 25,265 |
| Buckeye Pipe Line Co. of Mich |  | 160 | 4 | 164 | 9,676 | 6,866 | 16,542 | 1,079 | 166 | 1,245 | 41,614 | 256 | 2,945 | (3,681) |
| Butte Pipe Line Co. | — | 373 | — | 373 | 29,991 | — | 29,991 | 6,533 | — | 6,533 | 19,160 | 121 | 8,146 | 1,706 |

## LIQUID PIPELINES (continued)

| COMPANY | Miles of pipeline | | | | Deliveries, 1,000 bbl | | | Total trunkline traffic, million bbl-miles | | | Fiscal data, $1,000 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Trunk | | | | | | | | | | | | |
| | Gathering | Crude | Products | Total | Crude | Products | Total | Crude | Products | Total | Carrier property | Change | Operating revenue | Income |
| Calnev Pipe Line Co. | — | — | 583 | 583 | — | 29,455 | 29,455 | — | 5,754 | 5,754 | 98,005 | 9,822 | 20,102 | 4,076 |
| Chaparral Pipeline (NGL) Co. | — | — | 946 | 946 | — | 46,123 | 46,123 | — | 22,913 | 22,913 | 98,497 | 2,599 | 26,547 | 9,276 |
| Chase Transportation Co. | — | — | 716 | 716 | — | 12,882 | 12,882 | — | 4,436 | 4,436 | 38,616 | 12 | 7,687 | 4,217 |
| Chevron Pipe Line Co. | 2,014 | 2,818 | 3,291 | 8,123 | 346,273 | 244,804 | 591,077 | 23,218 | 48,164 | 71,382 | 617,459 | 10,695 | 200,587 | 76,010 |
| Chicap Pipe Line Co | — | 235 | — | 235 | 90,898 | — | 90,898 | 12,127 | — | 12,127 | 34,855 | 1,555 | 11,240 | 5,732 |
| Chisholm Pipeline Co. | — | — | 203 | 203 | — | 8,630 | 8,630 | — | 1,752 | 1,752 | 19,645 | (82) | 3,469 | 994 |
| Citgo Pipeline Co | 607 | 667 | 3 | 1,277 | 106,902 | 7,897 | 114,799 | 2,866 | 19 | 2,885 | 42,438 | 2,031 | 15,864 | 2,466 |
| CKB Petroleum Inc. | — | — | — | — | 862 | — | 862 | 45 | — | 45 | 4,757 | — | 2,368 | (55) |
| Clarco Pipe Line Co. | 90 | — | — | 90 | 1,316 | — | 1,316 | — | — | — | 3,681 | 57 | 364 | 11 |
| CNG Pipeline Co. | — | — | — | — | 1,257 | — | 1,257 | — | — | — | 4,511 | 366 | 1,399 | 560 |
| Coastal Pipeline Co. | — | — | 8 | 8 | — | 13,961 | 13,961 | — | 1,037 | 1,037 | 6,614 | 6 | 2,655 | 553 |
| Cochin Pipeline System | — | — | 1,197 | 1,197 | — | 23,722 | 23,722 | — | 20,792 | 20,792 | 240,894 | 341 | 53,598 | 29,553 |
| Collins Pipeline Co. | — | — | 124 | 124 | — | 43,434 | 43,434 | — | 5,386 | 5,386 | 15,731 | 387 | 4,553 | 354 |
| Colonial Pipeline Co. | — | — | 5,275 | 5,275 | — | 646,486 | 646,486 | — | 668,436 | 668,436 | 1,374,859 | 8,114 | 509,125 | 155,531 |
| Conoco Pipe Line Co. | 4,075 | 1,657 | 2,163 | 7,895 | 201,725 | 58,829 | 260,554 | 15,281 | 9,392 | 24,673 | 238,218 | 43,702 | 83,112 | 38,397 |
| Conquest Transmission Co.[4] | — | — | — | — | 4 | — | 4 | — | — | — | 150 | — | 26 | (580) |
| Cook Inlet Pipe Line Co. | — | 55 | — | 55 | 10,389 | — | 10,389 | 332 | — | 332 | 42,517 | 24 | 10,351 | (451) |
| Crown-Rancho Pipe Line Corp. | — | — | — | — | 5,004 | — | 5,004 | 1,927 | — | 1,927 | 2,155 | 26 | 1,677 | 1,188 |
| Cushing Lemont Pipeline Co. | — | 26 | — | 26 | 9,560 | — | 9,560 | 5,660 | — | 5,660 | 20,913 | 474 | 4,047 | 926 |
| CXY Offshore Systems Inc. | — | — | — | — | 35 | — | 35 | 3 | — | 3 | 1,661 | — | 59 | (73) |
| Diamond Shamrock R&M Co. | — | — | 622 | 622 | — | 14,045 | 14,045 | — | 6,609 | 6,609 | 34,458 | 143 | 11,765 | 2,496 |
| Dixie Pipeline Co. | — | — | 1,303 | 1,303 | — | 34,328 | 34,328 | — | 18,702 | 18,702 | 77,964 | 879 | 44,583 | 11,981 |
| Dome Pipeline Corp. | 1 | 8 | 134 | 143 | — | 9,285 | 9,285 | — | 192 | 192 | 22,765 | 18 | 2,932 | 14,637 |
| Emerald Pipe Line Corp. | — | — | 113 | 113 | — | 2,296 | 2 296 | — | 212 | 212 | 1,430 | — | 625 | 191 |
| Endicott Pipeline Co. | — | 25 | — | 25 | 36,936 | — | 36,936 | 922 | — | 922 | 55,658 | 72 | 26,224 | 10,672 |
| Enron Liquids Pipeline Co | — | — | 1,581 | 1,581 | — | 30,829 | 30,829 | — | 12,993 | 12,993 | 164,191 | 1,924 | 33,735 | 8,284 |
| Enterprise Pipeline Co. | — | — | 98 | 98 | — | — | — | — | — | — | 20,435 | — | — | — |
| EPC Partners Ltd. | — | — | 268 | 268 | — | — | — | — | — | — | 36,964 | — | — | — |
| Eureka Pipe Line Co. | 761 | 3 | 3 | 767 | 2,354 | — | 2,354 | 1 | — | 1 | 15,556 | — | 6,505 | 1,020 |
| Ewing Bank Pipeline Co. | — | 23 | — | 23 | 648 | — | 648 | 15 | — | 15 | 7,685 | (402) | 453 | 223 |
| Explorer Pipeline Co. | — | — | 1,397 | 1,397 | — | 180,231 | 180,231 | — | 126,813 | 126,813 | 259,046 | 2,486 | 110,006 | 37,226 |
| Exxon Pipeline Co. | 1,856 | '4,928 | 2,555 | '9,339 | 405,176 | 111,618 | 516,794 | 154,048 | 8,293 | 162,341 | 2,214,948 | 12,101 | 537,988 | 355,501 |
| Farmland Industries Inc. | 624 | 239 | — | 863 | 21,895 | — | 21,895 | 755 | — | 755 | 12,029 | 447 | 3,584 | — |
| Four Corners Pipe Line Co. | 281 | 1,183 | 14 | 1,478 | 104,353 | 179 | 104,532 | 18,279 | 1 | 18,280 | 162,876 | 7,214 | 38,634 | 7,075 |
| Frontier Pipeline Co. | — | 290 | — | 290 | — | — | — | — | — | — | 48,849 | — | — | (4,656) |
| Giant Industries Ariz. (Ciniza) | 233 | 135 | 11 | 379 | 6,760 | 1,709 | 8,469 | 435 | 20 | 455 | 6,929 | 71 | 2,920 | 10,894 |
| Gulf Central Pipeline Co. | — | — | 1,975 | 1,975 | — | 12,747 | 12,747 | — | — | — | 70,736 | 1,175 | 24,665 | 10,878 |
| Hess Pipeline Co. | — | 442 | — | 442 | 30,272 | — | 30,272 | 1,983 | — | 1,983 | 47,224 | 1,808 | 12,681 | 3,355 |
| Howell Crude Oil Co. | — | 6 | — | 6 | 735 | — | 735 | — | — | — | 1,313 | — | 225 | 1,182 |
| Interstate Storage & Pipeline Co. | — | — | 23 | 23 | — | 1,935 | 1,935 | — | — | — | 3,218 | — | 1,501 | 423 |
| Jayhawk Pipeline Corp. | 824 | 657 | — | 1,481 | 45,463 | — | 45,463 | 3,745 | — | 3,745 | 27,525 | 607 | 11,828 | 3,091 |
| Jolliet Pipe Line Co. | 29 | — | — | 29 | 13 | — | 13 | — | — | — | 11,843 | 11,843 | 9 | 118 |
| Kaneb Pipe Line Optg Ptshp. L.P.• | — | — | 2,080 | 2,080 | — | 52,366 | 52,366 | — | 12,944 | 12,944 | 108,445 | 181 | 37,462 | 13,543 |
| Kerr-McGee Pipeline Corp. | 8 | 56 | — | 64 | 1,371 | — | 1,371 | 37 | — | 37 | 7,115 | 1,543 | 1,825 | 1,480 |
| Kiantone Pipeline Corp. | — | 78 | — | 78 | 21,120 | — | 21,120 | 21 | — | 21 | 10,502 | 395 | 4,435 | 1,169 |
| Koch Pipelines Inc. | 1,063 | 1,138 | 1,185 | 3,386 | 60,403 | 52,128 | 112,531 | 5,948 | 10,668 | 16,616 | 302,182 | 7,761 | 66,649 | 19,374 |
| Kuparak Transportation Co. | — | 37 | — | 37 | 112,972 | — | 112,972 | 3,648 | — | 3,648 | 126,451 | 576 | 69,801 | 56,308 |
| Lake Charles Pipe Line Co. | — | — | 13 | 13 | — | 81,110 | 81,110 | — | 424 | 424 | 11,052 | 114 | 4,055 | 1,244 |
| Lakehead Pipe Line Co. Inc. | — | 2,615 | — | 2,615 | 454,553 | — | 454,553 | 354,845 | — | 354,845 | 547,545 | 9,881 | 209,010 | 54,056 |
| Largo Co., The | — | — | — | — | 925 | — | 925 | 43 | — | 43 | 12,654 | — | 1,774 | (21,961) |
| Laurel Pipe Line Co. | — | — | 351 | 351 | — | 35,590 | 35,590 | — | 5,683 | 5,683 | 47,113 | 134 | 16,112 | 5,078 |
| Locap Inc. | — | 59 | — | 59 | 216,766 | — | 216,766 | 12 | — | 12 | 120,564 | 75 | 19,789 | 3,806 |
| Mapco Ammonia Pipeline Inc./ | — | — | — | — | — | 9 | 9 | — | 3,412 | 3,412 | 37,646 | 79 | 7,169 | 1,102 |
| Marathon Pipe Line Co. | 1,218 | 1,716 | 1,469 | 4,403 | 378,163 | 265,931 | 644,094 | 64,617 | 20,293 | 84,910 | 367,875 | 6,333 | 157,951 | 54,300 |
| Mark Oil Pipeline Co. (final) | — | — | — | — | — | — | — | — | — | — | — | (922) | — | 49 |
| McMoran Pipeline Co. | — | — | — | — | 101 | — | 101 | 10 | — | 10 | 1,761 | — | 298 | 55 |

# LIQUID PIPELINES (continued)

| | Miles of pipeline | | | | Deliveries, 1,000 bbl | | | Total trunkline traffic, million bbl-miles | | | Fiscal data, $1,000 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Trunk | | | | | | | | | | | | |
| COMPANY | Gathering | Crude | Products | Total | Crude | Products | Total | Crude | Products | Total | Carrier property | Change | Operating revenue | Income |
| Meridan Oil Frontera Inc. | — | — | — | — | 295 | — | 295 | 32 | — | 32 | 1,378 | — | 545 | 180 |
| Mesa Transmission Co. | — | 11 | — | 11 | 578 | — | 578 | 37 | — | 37 | 10,569 | (1) | 1,017 | (261) |
| Mid-America Pipeline Co. | — | 19 | 6,982 | 7,001 | 33,664 | 127,724 | 161,388 | 4,367 | 50,149 | 54,516 | 450,437 | (23,646) | 135,895 | 34,652 |
| Mid-Valley Pipe Line Co. | — | 95 | — | 95 | 122,619 | — | 122,619 | 61,880 | — | 61,880 | 101,492 | 1,153 | 40,558 | 11,901 |
| Midland-Lea Inc. | — | 101 | 275 | 376 | — | 139 | 139 | 29 | — | 29 | 22,296 | 1,971 | 586 | (997) |
| Milne Point Pipe Line Co. | 11 | — | — | 11 | 3,706 | — | 3,706 | — | — | — | 26,881 | (49) | 7,078 | 4,662 |
| Minnesota Pipe Line Co. | — | 675 | — | 675 | 74,531 | — | 74,531 | 19,005 | — | 19,005 | 108,546 | 65,133 | 25,341 | 6,425 |
| Mitco Pipeline Co. | 9 | — | — | 9 | — | — | — | — | — | — | 2,105 | — | 23 | (952) |
| Mobil Alaska Pipeline Co. | — | *818 | — | *818 | 28,212 | — | 28,212 | 22,426 | — | 22,426 | 400,218 | 1,778 | 83,004 | 31,401 |
| Mobil Eugene Island Pipeline Co. | — | 134 | — | 134 | 27,268 | — | 27,268 | 1,850 | — | 1,850 | 47,054 | 89 | 22,427 | 12,538 |
| Mobil Pipe Line Co. | 3,313 | 4,670 | 1,738 | 9,721 | 210,836 | 106,286 | 317,122 | 65,008 | 12,067 | 77,075 | 322,013 | 13,920 | 153,836 | 66,157 |
| National Transit Co. | 165 | — | — | 165 | 330 | — | 330 | — | — | — | 3,616 | (3) | 886 | (32) |
| Navajo Pipeline Co. | — | 70 | 323 | 393 | — | 5,290 | 5,290 | — | 1,115 | 1,115 | 10,930 | 2,373 | 5,535 | 2,922 |
| Northern Rockies Pipe Line Co. | — | 77 | — | 77 | 442 | — | 442 | 34 | — | 34 | 1,049 | — | 158 | 314 |
| NW Pipeline Co. | — | — | — | — | 2,616 | — | 2,616 | 260 | — | 260 | 6,391 | 4 | 2,835 | 1,624 |
| Ohio Oil Gathering Corp. | 157 | 2 | — | 159 | 4,009 | — | 4,009 | — | — | — | 11,171 | (831) | 7,434 | 1,624 |
| Ohio River Pipe Line Co. | — | — | 400 | 400 | — | 15,497 | 15,497 | — | 2,050 | 2,050 | 27,767 | 3,246 | 8,648 | 2,736 |
| Oiltanking Pipeline Inc. | — | 13 | 16 | 29 | 58,472 | 482 | 58,954 | 721 | 3 | 724 | 15,874 | 296 | 5,728 | 1,931 |
| Olympic Pipe Line Co. | — | — | 416 | 416 | — | 94,470 | 94,470 | — | 17,129 | 17,129 | 60,595 | (1,046) | 28,620 | 7,663 |
| Osage Pipe Line Co. | — | 136 | — | 136 | 32,983 | — | 32,983 | 4,471 | — | 4,471 | 19,531 | — | 6,401 | 2,027 |
| Owensboro-Ashland Co. | — | 266 | — | 266 | 64,993 | — | 64,993 | 17,255 | — | 17,255 | 45,213 | 672 | 10,881 | 1,983 |
| Oxy NGL Pipeline Co. | — | — | 106 | 106 | — | 5,277 | 5,277 | — | 563 | 563 | 3,703 | 452 | 1,265 | 398 |
| Oxy Pipeline Inc. | — | — | — | — | 1,279 | — | 1,279 | 43 | — | 43 | 3,904 | (1,221) | 934 | 78 |
| Paloma Pipe Line Co. | — | — | — | — | 21,858 | — | 21,858 | 1,429 | — | 1,429 | 5,843 | 82 | 2,572 | 1,043 |
| Pennzoil Offshore Pipeline Co. | — | 4 | — | 4 | 332 | — | 332 | 9 | — | 9 | 4,025 | — | 281 | (103) |
| Permian Operating L P. | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Phillips Alaska Pipeline Corp. | — | *818 | — | *818 | 9,811 | — | 9,811 | 7,382 | — | 7,382 | 127,512 | 596 | 27,737 | 10,022 |
| Phillips Pipe Line Co. | 1,066 | 855 | 4,137 | 6,058 | 67,161 | 202,061 | 269,222 | 14,521 | 44,516 | 59,037 | 413,458 | 33,367 | 151,348 | 41,286 |
| Pioneer Pipe Line Co. | — | — | 299 | 299 | — | 12,704 | 12,704 | — | 2,985 | 2,985 | 14,101 | 376 | 6,546 | 1,646 |
| PL Pipeline Co. | — | — | — | — | 50 | — | 50 | 6 | — | 6 | 1,039 | — | 95 | (39) |
| Plantation Pipe Line Co. | — | — | 3,160 | 3,160 | — | 187,466 | 187,466 | — | 118,323 | 118,323 | 310,618 | 7,112 | 116,926 | 25,563 |
| Plantex Pipeline Co. | — | — | 27 | 27 | — | 276 | 276 | — | 7 | 7 | 2,521 | — | 373 | 118 |
| Platte Pipe Line Co. | — | 1,282 | — | 1,282 | 40,916 | — | 40,916 | 25,737 | — | 25,737 | 80,220 | 209 | 25,355 | 10,011 |
| Pogo Offshore Pipeline Co. | — | — | — | — | 184 | — | 184 | 6 | — | 6 | 1,331 | — | 318 | — |
| Point Arguello Pipeline Co. (new) | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Point Pedernales Pipeline Co. | — | 46 | — | 46 | 7,282 | — | 7,282 | 167 | — | 167 | 52,000 | 1,510 | 19,763 | 6,740 |
| Portal Pipe Line Co. | 294 | 614 | — | 908 | 18,798 | — | 18,798 | 6,400 | — | 6,400 | 44,788 | 260 | 11,392 | 3,761 |
| Portland Pipe Line Corp. | — | 177 | — | 177 | 30,027 | — | 30,027 | 5,086 | — | 5,086 | 42,165 | 101 | 19,268 | 2,240 |
| Quest Petrochemical Co.* | — | — | 125 | 125 | — | 1,444 | 1,444 | — | 181 | 181 | 12,136 | — | 500 | 4,223 |
| Razorback Pipeline Co. (new) | — | — | — | — | — | 221 | 221 | — | 15 | 15 | 11,085 | 11,085 | 149 | (225) |
| Samedan Pipeline Corp. (new) | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Scana Hydrocarbons Inc.** | — | — | 62 | 62 | — | 231 | 231 | — | 78 | 78 | 351 | — | 219 | (182) |
| Seminole Pipeline Co. | 106 | — | 634 | 740 | — | 42,488 | 42,488 | — | 19,702 | 19,702 | 204,612 | (173) | 26,872 | 7,859 |
| Shamrock Pipe Line Corp., | 649 | 318 | 580 | 1,547 | 44,626 | 27,263 | 71,889 | 3,227 | 3,317 | 6,544 | 40,795 | 5,599 | 18,195 | 2,011 |
| Shell Pipe Line Corp. | 2,067 | 4,746 | 431 | 7,244 | 422,401 | 120,693 | 543,094 | 95,712 | 5,781 | 101,493 | 483,061 | 7,073 | 161,[illegible]76 | 56,045 |
| Sonat Oil Transmission Inc. | — | 42 | — | 42 | 890 | — | 890 | 10 | — | 10 | 5,505 | — | 1,003 | 765 |
| Southcap Pipe Line Co. | — | — | — | — | 62,819 | — | 62,819 | 39,873 | — | 39,873 | 51,985 | (19) | 16,130 | 832 |
| Southern Pacific Pipe Line L.P. | — | — | 3,297 | 3,297 | — | 324,518 | 324,518 | — | 44,354 | 44,354 | 462,984 | 16,538 | 154,802 | 59,884 |
| Sun Oil Line Co of Michigan | — | 201 | — | 201 | 9,976 | — | 9,976 | 2,009 | — | 2,009 | 669 | — | 3,937 | 1,194 |
| Sun Pipe Line Co. | 374 | 419 | 1,737 | 2,530 | 50,685 | 130,356 | 181,041 | 2,990 | 11,330 | 14,320 | 158,822 | 8,883 | 63,509 | 8,917 |
| Tecumseh Pipe Line Co. | — | 205 | — | 205 | 18,993 | — | 18,993 | 1,155 | — | 1,155 | 15,279 | 9 | 3,558 | 1,241 |
| Texaco Pipeline Inc. | 1,933 | 3,152 | 1,252 | 6,337 | 370,283 | 125,551 | 495,834 | 67,613 | 7,767 | 75,380 | 452,605 | 28,240 | 123,312 | 28,870 |
| Texas Eastern Products Pl. Co. | — | — | 3,373 | 3,373 | — | 118,359 | 118,353 | — | 61,071 | 61,071 | 292,263 | 9,574 | 90,225 | 29,505 |
| Texas-New Mexico Pipe Line Co. | 1,715 | 2,184 | — | 3,899 | 107,381 | — | 107,381 | 10,742 | — | 10,742 | 94,262 | 3,436 | 28,905 | 9,278 |
| Total Pipeline Corp. | 193 | 635 | 129 | 957 | 71,146 | 16,226 | 87,372 | 9,632 | 1,452 | 11,084 | 58,462 | 10,214 | 13,677 | (257) |
| Trans Mountain Oil Pl. Corp. | — | 64 | — | 64 | 6,184 | — | 6,184 | 308 | — | 308 | 7,112 | 355 | 1,985 | 844 |
| Trans-Ohio Pipeline Co. | — | — | 133 | 133 | — | 5,619 | 5,619 | — | 231 | 231 | 8,297 | 20 | 1,554 | 615 |

## LIQUID PIPELINES *(continued)*

| | Miles of pipeline | | | | Deliveries, 1,000 bbl | | | Total trunkline traffic, million bbl-miles | | | Fiscal data, $1,000 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Trunk | | | | | | | | | | | | |
| **COMPANY** | **Gathering** | **Crude** | **Products** | **Total** | **Crude** | **Products** | **Total** | **Crude** | **Products** | **Total** | **Carrier property** | **Change** | **Operating revenue** | **Income** |
| Transco Terminal Co. | — | — | — | — | 434 | — | 434 | — | — | — | 3,274 | 3 | | |
| Unocal Pipeline Co. | 311 | *1,498 | 16 | *1,825 | 58,044 | 4,835 | 62,879 | 10,844 | 57 | 10,901 | 193,049 | (6,135) | 42,707 | 15,908 |
| West Emerald Pipeline Corp. | — | — | 296 | 296 | — | 2,529 | 2,529 | — | 606 | 606 | 6,213 | 4,266 | 1,341 | 169 |
| West Shore Pipe Line Co. | — | — | 321 | 321 | — | 67,628 | 67,628 | — | 8,248 | 8,248 | 35,840 | 582 | 18,218 | 5,492 |
| West Texas Gulf Pipe Line Co. | — | 579 | — | 579 | 112,420 | — | 112,420 | 45,569 | — | 45,569 | 48,001 | 833 | 27,987 | 11,108 |
| Western Oil Transportation | 584 | — | — | 584 | 13,053 | — | 13,053 | — | — | — | 31,036 | 213 | 7,067 | (8,037) |
| Whiskey Springs Oil Pipeline Co. | 7 | — | — | 7 | 941 | — | 941 | — | — | — | 650 | 44 | 226 | (99) |
| White Shoal Pipeline Corp. | 7 | — | — | 7 | 2,394 | — | 2,394 | 107 | — | 107 | 2,644 | 2 | 246 | 10 |
| Williams Pipe Line Co. | — | — | 6,645 | 6,645 | 2,787 | 168,506 | 171,293 | 1,668 | 50,633 | 52,301 | 592,260 | 33,420 | 134,464 | 14,792 |
| Wolverine Pipe Line Co. | — | — | 621 | 621 | — | 89,381 | 89,381 | — | 11,707 | 11,707 | 73,343 | 651 | 27,855 | 9,012 |
| Wyco Pipe Line Co. | — | — | 677 | 677 | — | 20,136 | 20,136 | — | 3,577 | 3,577 | 30,298 | 1,509 | 15,261 | 6,278 |
| Yellowstone Pipe Line Co. | — | — | 752 | 752 | — | 25,064 | 25,064 | — | 8,395 | 8,395 | 31,557 | 1,972 | 15,575 | 4,817 |
| **1989 Totals** | **33,349** | **55,664** | **79,624** | **168,637** | **6,434,559** | **4,846,481** | **11,281,040** | **1,917,872** | **1,586,789** | **3,504,661** | **24,637,756** | **508,984** | **6,511,997** | **2,226,627** |
| 1988 Totals | 34,311 | 55,900 | 80,246 | 170,457 | 6,509,367 | 4,974,279 | 11,483,646 | 1,969,467 | 1,649,223 | 3,618,690 | 24,331,493 | 678,817 | 6,861,938 | 2,504,986 |

Source: U.S. FERC Form No. 6's: Annual Report of Oil Pipelines, Dec. 31, 1989.

* Mileage represents Trans-Alaska Pipeline and is included in total only once to avoid duplication. † Previous name Sohio Pipe Line Co., Feb. 17, 1989.

§ Adopted Sohio Alaska Pipeline, Mar. 1, 1989. ¶ Previous name Cenergy Transmission Corp., Dec. 28, 1989. • Previous name Kaneb Pipe Line Co., Nov. 25, 1989. / Adopted Mid-American Pipeline Co., Jan. 1, 1989.

≠ Previous name Enterprise Products of Mississippi, Jan. 1, 1989. ** Previous name C&T Pipeline Inc., Dec. 31, 1989.

## GAS PIPELINES

| | Miles of pipeline | | | | Total compressor stations | | | Volumes, MMcf | | Fiscal data, $1,000 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Company** | **Transmission** | **Field** | **Storage** | **Total** | **Transmission** | **Other** | **Total** | **Sold** | **Trans. for others** | **Gas plant** | **Additions** | **Operating revenues** | **Net income** |
| Alabama-Tennessee Natural Gas Co. | 287 | — | — | 287 | 2 | — | 2 | 13,309 | 21,718 | 21,565 | 549 | 44,758 | (4,662) |
| Algonquin Gas Transmission Co.* | 985 | — | — | 985 | 5 | — | 5 | 132,414 | 99,238 | 373,266 | 9,572 | 547,828 | 17,357 |
| Algonquin LNG Inc. | | — | — | — | — | — | — | — | — | 22,041 | 66 | 3,962 | 647 |
| American Distribution Co. | 38 | — | — | 38 | — | — | — | 791 | 13,304 | 4,766 | — | 1,852 | 548 |
| ANR Pipeline Co. * | 9,213 | 2,215 | 196 | 11,624 | 46 | 45 | 91 | 192,268 | 1,040,937 | 2,557,541 | 59,298 | 1,220,432 | 170,693 |
| ANR Storage Co. | — | — | 24 | 24 | — | 3 | 3 | — | — | 121,921 | 643 | 37,356 | 21,441 |
| Arkansas Oklahoma Gas Corp. | 361 | 175 | — | 536 | 5 | — | 5 | 12,929 | 10,872 | 65,628 | 5,534 | 45,180 | 3,027 |
| Arkansas Western Gas Co. | 1,309 | 364 | — | 1,673 | 5 | — | 5 | 28,397 | 4,748 | 141,650 | 9,257 | 118,610 | 1,043 |
| Arkla Inc.* | 6,405 | 3,581 | 67 | 10,053 | 25 | 134 | 159 | 247,490 | 441,085 | 2,274,335 | 207,928 | 1,376,238 | — |
| Bayou Interstate Pipeline System | 2 | — | — | 2 | — | — | — | 1,021 | — | 42 | — | 1,960 | (71) |
| Bear Creek Storage Co. | — | — | 25 | 25 | — | 1 | 1 | — | — | 143,821 | 322 | 44,486 | 12,630 |
| Black Marlin Pipeline Co. | 67 | — | — | 67 | — | — | — | 40,317 | — | 35,686 | 13,471 | 3,697 | 1,442 |
| Blue Dolphin Pipe Line Co. | 49 | — | — | 49 | — | — | — | — | 9,452 | 7,670 | — | 674 | (1,517) |
| Bluefield Gas Co. | 32 | — | — | 32 | — | — | — | 968 | — | 2,484 | 140 | 4,619 | 67 |
| Boundary Gas Inc. | — | — | — | — | — | — | — | 33,287 | — | — | — | 86,508 | — |
| Canyon Creek Compression Co. | 1 | — | — | 1 | 1 | — | 1 | — | 48,008 | 22,204 | 52 | 8,071 | 1,527 |
| Caprock Pipeline Co. | 18 | 38 | — | 56 | 2 | 2 | 4 | 55 | 44,481 | 4,470 | 662 | 2,037 | 1,706 |
| Carnegie Natural Gas Co. | 216 | 873 | — | 1,089 | 7 | 5 | 12 | 19,384 | 3,194 | 79,356 | 4,603 | 68,980 | 1,060 |
| Chandeleur Pipe Line Co. | 174 | — | — | 174 | — | — | — | — | 28,305 | 20,869 | 35 | 940 | (160) |
| Cimarron Transmission Co. (final-3 mo.) | — | 41 | — | 41 | — | — | — | 555 | 57 | 1,545 | 14 | 991 | (13) |
| CNG Transmission Corp. * | 3,750 | 4,122 | 520 | 8,392 | 60 | 36 | 96 | 242,904 | 339,284 | 1,402,236 | 127,924 | 1,311,485 | 61,304 |
| Colorado Interstate Gas Co. * | 3,024 | 3,051 | 57 | 6,132 | 27 | 36 | 63 | 107,637 | 327,967 | 726,074 | 14,572 | 431,610 | 67,339 |
| Columbia Gas Transmission Corp. * | 10,898 | 6,611 | 1,207 | 18,716 | 109 | 69 | 178 | 432,813 | 784,044 | 2,072,543 | 79,839 | 1,813,919 | 65,385 |
| Columbia Gulf Transmission Co. * | 4,278 | — | — | 4,278 | 13 | 20 | 33 | — | 963,826 | 1,097,460 | 24,605 | 144,753 | 24,282 |
| Columbia LNG Corp. | 88 | — | — | 88 | — | — | — | — | 12,373 | 201,952 | 24 | 12,637 | 1,104 |
| Consolidated System LNG Co. | — | — | — | — | — | — | — | — | — | — | — | 20,866 | 4,845 |
| Distrigas of Mass. Corp. | — | — | — | — | — | — | — | 37,963 | — | 50,610 | 1,691 | 119,859 | 630 |
| East Tennessee Natural Gas Co. * | 1,094 | — | — | 1,094 | 15 | 1 | 16 | 95,018 | 51 | 151,890 | 9,368 | 264,258 | 5,939 |
| Eastern Natural Gas Co. | — | — | — | — | — | — | — | 1,302 | — | 5,049 | 186 | 6,017 | (325) |

# GAS PIPELINES (continued)

| Company | Miles of pipeline: Transmission | Miles of pipeline: Field | Miles of pipeline: Storage | Miles of pipeline: Total | Total compressor stations: Transmission | Total compressor stations: Other | Total compressor stations: Total | Volumes, MMcf: Sold | Volumes, MMcf: Trans. for others | Fiscal data, $1,000: Gas plant | Fiscal data, $1,000: Additions | Fiscal data, $1,000: Operating revenues | Fiscal data, $1,000: Net income |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Eastern Shore Natural Gas Co. | — | — | — | — | — | — | — | 7,893 | 3,318 | 16,884 | 1,986 | 27,865 | 1,404 |
| El Paso Natural Gas Co. * | 10,705 | 9,909 | 18 | 20,632 | 88 | 12 | 100 | 131,425 | 1,191,569 | 2,538,849 | 77,163 | 1,100,385 | 154,489 |
| Enron Corp./Northern Natural Pl.* | 16,458 | 213 | — | 16,671 | 121 | 3 | 124 | 332,779 | 1,429,593 | 2,209,085 | 53,111 | 1,278,181 | 226,333 |
| Enserch Corp. | 8,283 | 2,300 | — | 10,583 | 44 | — | 44 | 209,715 | 303,271 | 1,291,164 | 68,867 | 1,085,697 | 73,352 |
| Equitrans Inc.* | 530 | 1,482 | 135 | 2,147 | 6 | 20 | 26 | 51,531 | 20,970 | 200,800 | 4,686 | 199,984 | 5,857 |
| Florida Gas Transmission Co. * | 4,426 | — | — | 4,426 | 44 | — | 44 | 272,040 | 19,205 | 572,539 | 10,000 | 715,679 | 43,174 |
| Freeport Interstate Pipeline Co. | 9 | — | — | 9 | — | — | — | — | 3,486 | — | — | 19 | 2 |
| Gas Gathering Corp. | — | 31 | — | 31 | — | — | — | — | 1,392 | 1,606 | 17 | 152 | (22) |
| Gas Transport Inc. | 41 | 68 | — | 109 | — | — | — | 1,713 | — | 3,870 | 72 | 5,726 | 117 |
| Gasdel Pipeline System Inc. | 160 | — | — | 160 | — | — | — | — | 8,071 | 14,216 | 158 | 1,760 | 955 |
| Glacier Gas Co. | 34 | 3 | — | 37 | 1 | — | 1 | 327 | — | 2,340 | 5 | 382 | 25 |
| Granite State Gas Transmission Inc. | 105 | — | — | 105 | 1 | — | 1 | 40,579 | 331 | 10,289 | 367 | 137,736 | 1,002 |
| Great Lakes Gas Transmission Co. * | 1,321 | — | — | 1,321 | 14 | — | 14 | 53,771 | 464,878 | 555,382 | 11,657 | 245,125 | 29,997 |
| Great Plains Natural Co. | 65 | — | — | 65 | — | — | — | 4,573 | — | 16,351 | 699 | 17,264 | 1,053 |
| Greely Gas Co. | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Hampshire Gas Co. | — | 18 | — | 18 | — | 1 | 1 | — | — | 8,991 | 189 | 2,553 | 694 |
| High Island Offshore System * | 203 | — | — | 203 | 1 | — | 1 | — | 494,753 | 363,974 | 720 | 65,589 | 15,496 |
| Honeoye Storage Co. | 11 | 19 | — | 30 | — | 1 | 1 | 49 | — | 8,785 | 10 | 2,099 | 366 |
| Indiana Utilities Corp. | 21 | — | — | 21 | — | — | — | 395 | — | 2,442 | 136 | 1,772 | 180 |
| Inland Gas Co. | 128 | 394 | — | 522 | — | 5 | 5 | 3,567 | 2,087 | 23,188 | 1,105 | 16,047 | 401 |
| Inter-City Minnesota Pipelines Ltd. | 66 | — | — | 66 | — | — | — | — | — | — | — | — | — |
| Interstate Power Co. | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Iowa-Illinois Gas and Electric Co. | — | — | — | — | — | — | — | 45,906 | 12,887 | 203,210 | 15,339 | 494,084 | 58,544 |
| Jupiter Energy Corp. | 27 | — | — | 27 | — | — | — | — | 13,151 | 2,441 | — | 413 | 177 |
| K N Energy Inc. * | 9,302 | 2,922 | 24 | 12,248 | 28 | 71 | 99 | 79,419 | 29,547 | 460,577 | 20,213 | 318,851 | 14,753 |
| Kentucky West Virginia Gas Co. | 123 | 2,079 | — | 2,202 | 9 | 3 | 12 | 9,315 | 19,136 | 82,310 | 5,602 | 56,266 | 14,060 |
| Lone Star Gathering Co. | 39 | 3 | — | 42 | — | — | — | — | 149 | 1,620 | — | 343 | 96 |
| Louisiana-Nevada Transit Co. | 78 | — | — | 78 | — | — | — | 2,278 | 190 | 2,886 | 217 | 5,053 | 379 |
| Michigan Consolidated Gas Co.* | 2,264 | 122 | 112 | 2,498 | 60 | 8 | 68 | 212,880 | 135,406 | 1,588,415 | 83,332 | 1,177,635 | 52,022 |
| Michigan Gas Storage Co. * | 562 | — | 148 | 711 | 1 | 1 | 2 | 15,423 | 134,155 | 55,530 | 1,196 | 56,005 | 2,616 |
| Mid Louisiana Gas Co. | 413 | 474 | — | 887 | — | 1 | 1 | 19,266 | 4,280 | 93,330 | 5,099 | 54,390 | 9,698 |
| Midwestern Gas Transmission Co. * | 353 | — | — | 353 | 15 | — | 15 | 80,742 | 12,040 | 96,569 | 2,984 | 281,054 | 7,924 |
| MIGC Inc. | 200 | 10 | — | 210 | 3 | 2 | 5 | 2,058 | 15,643 | 13,881 | 28 | 9,258 | (741) |
| Miss. River Transmission Corp. * | 2,018 | 65 | 79 | 2,162 | 15 | 5 | 20 | 152,097 | 5,648 | 453,378 | 26,099 | 459,668 | 19,999 |
| Mitco Pipeline Co. | — | 9 | — | 9 | — | — | — | — | 175 | 2,105 | — | 67 | — |
| Moraine Pipeline Co. (new)* | 18 | — | — | 18 | — | — | — | — | 13,694 | 7,419 | 108 | 426 | (701) |
| National Fuel Gas Distribution Corp. | 578 | 333 | — | 911 | — | 2 | 2 | 128,890 | 33,334 | 755,232 | 41,825 | 732,752 | 28,500 |
| National Fuel Gas Supply Corp. * | 1,369 | 1,442 | 462 | 3,273 | 13 | 3 | 16 | 151,619 | 76,322 | 321,554 | 14,018 | 541,838 | 22,451 |
| Natural Gas Pipeline of America * | 10,699 | 1,758 | 295 | 12,752 | 56 | 20 | 76 | 369,970 | 1,304,010 | 2,461,923 | 35,286 | 1,715,315 | 111,696 |
| Nora Transmission Co. (new) | 16 | — | — | 16 | — | — | — | — | — | 1,695 | — | 429 | (162) |
| North Penn Gas Co. | 566 | 253 | — | 819 | — | — | — | 6,030 | 2,721 | 50,970 | 4,331 | 38,445 | 4,026 |
| Northern Border Pipeline Co. * | 824 | — | — | 824 | 2 | — | 2 | — | 389,271 | 1,295,700 | 568 | 228,566 | 47,557 |
| Northwest Alaskan Pipeline Co.* | — | — | — | — | — | — | — | 189,589 | — | — | — | 378,805 | (1,108) |
| Northwest Pipeline Corp. * | 3,560 | 3,415 | 7 | 6,982 | 40 | 16 | 56 | 50,685 | 645,007 | 1,354,826 | 32,846 | 405,469 | 31,042 |
| Ohio River Pipeline Corp. | 24 | — | — | 24 | — | — | — | 4,891 | — | 3,685 | 32 | 16,671 | 192 |
| Orange & Rockland Utilities Inc. | — | — | — | — | — | — | — | 21,793 | — | 141,250 | 10,730 | 484,195 | 44,144 |
| Overthrust Pipeline Co.* | 89 | — | — | 89 | — | — | — | — | 65,704 | 63,041 | — | 10,418 | 2,258 |
| Ozark Gas Transmission System | — | — | — | — | — | — | — | — | 37,911 | 146,635 | 531 | 25,273 | 3,172 |
| Pacific Gas Transmission Co. * | 799 | 42 | — | 841 | 13 | — | 13 | 373,328 | 116,267 | 423,348 | 9,689 | 863,996 | 20,967 |
| Pacific Interstate Offshore Co. | — | — | — | — | — | — | — | 12,118 | — | 12,014 | — | 33,742 | 314 |
| Pacific Interstate Transmission Co. | 351 | — | — | 351 | 2 | — | 2 | 81,026 | — | 63,046 | 85 | 292,877 | 1,166 |
| Pacific Offshore Pipeline Co. | — | — | — | — | — | — | — | 11,066 | — | 150,634 | 1,885 | 69,850 | 4,529 |
| Paiute Pipeline Co. | 784 | — | — | 784 | 4 | — | 4 | 35,362 | 52 | 57,707 | 8,505 | 63,491 | 608 |
| Panhandle Eastern Pipe Line Co. * | 6,604 | 5,861 | 130 | 12,595 | 66 | 69 | 135 | 423 | 20,641 | 1,604,516 | 34,944 | 533,680 | (19,339) |
| Pelican Interstate Gas System | 85 | — | — | 85 | — | — | — | — | 29,418 | 11,082 | — | 2,012 | 54 |
| Penn-Jersey Pipe Line Co. | 4 | — | — | 4 | — | — | — | — | 721 | 233 | — | 45 | 50 |
| Penn-York Energy Corp. | — | — | 39 | 39 | — | 2 | 2 | — | — | 60,186 | (2,421) | 25,786 | 6,590 |
| Pennsylvania & Southern Gas Co. | — | — | — | — | — | — | — | 4,648 | 1,608 | 21,189 | 2,362 | 23,280 | 679 |

# GAS PIPELINES (continued)

| Company | Miles of pipeline |  |  |  | Total compressor stations |  |  | Volumes, MMcf |  | Fiscal data, $1,000 |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Transmission | Field | Storage | Total | Transmission | Other | Total | Sold | Trans. for others | Gas plant | Additions | Operating revenues | Net income |
| Phillips Gas Pipeline Co. | 164 | — | — | 164 | — | — | — | 22 | 68,947 | 54,935 | 6,344 | 4,782 | (92) |
| Point Arguello Natural Gas Line (new) | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Questar Pipeline Co. * | 1.573 | 439 | 50 | 2,062 | 11 | 28 | 39 | 52,454 | 123,051 | 377,838 | 12,859 | 226,059 | 22,602 |
| Raton Gas Transmission Co. Inc. | 21 | — | — | 21 | — | — | — | 1.098 | — | 535 | — | 3,286 | 59 |
| Ringwood Gathering Co. | 43 | 273 | — | 316 | — | 2 | 2 | 2,150 | 6,996 | 10.829 | 285 | 6,841 | 314 |
| Sabine Pipe Line Co. | 193 | — | — | 193 | 1 | — | 1 | — | 108,603 | 45,177 | 6,133 | 5,206 | 505 |
| Sea Robin Pipeline Co. * | 420 | — | — | 420 | 3 | 1 | 4 | 297 | 230,332 | 253,145 | 1,061 | 122,450 | (32,700) |
| Seagull Interstate Corp. | 7 | 5 | — | 12 | — | — | — | — | 8,777 | 6,234 | — | 555 | (603) |
| Shenandoah Gas Co. | 85 | — | — | 85 | — | — | — | 4,392 | — | 2,222,203 | 4,728 | 18,813 | 588 |
| South County Gas Co. | — | — | — | — | — | — | — | 433 | 153 | 3,660 | 291 | 3,583 | 167 |
| South Georgia Natural Gas Co. | 767 | — | — | 767 | 2 | — | 2 | 4.064 | 22,208 | 23,836 | 580 | 29.662 | (4,588) |
| South Penn Gas Co. | 17 | — | — | 17 | — | — | — | 314 | — | 711 | 60 | 1,283 | 17 |
| Southeastern Natural Gas Co. of Ohio | — | — | — | — | — | — | — | 13 | — | 5 | — | 714 | (14) |
| Southern Energy Co.(LNG) | — | — | — | — | — | — | — | — | — | 155,260 | 38 | 11,979 | 1,005 |
| Southern Natural Co. * | 7,611 | 111 | 48 | 7,770 | 50 | 20 | 70 | 152,406 | 405,393 | 1,360,873 | 68,196 | 1,119,112 | 91,777 |
| Southwest Gas Storage Co. | — | — | 31 | 31 | — | 1 | 1 | — | — | 69,004 | 36 | 15,893 | 3,580 |
| Southwest Gas Transmission Co. | — | 8 | — | 8 | — | — | — | — | 14,501 | 1,539 | — | 356 | 80 |
| Stingray Pipeline Co. * | 354 | — | — | 354 | 2 | — | 2 | — | 322,009 | 247,805 | 8 | 52,409 | 17,740 |
| Superior Offshore Pipeline Co. | 112 | — | — | 112 | — | — | — | — | — | — | — | — | — |
| T C P Gathering Co. | — | 20 | — | 20 | — | — | — | — | 1,376 | 1,163 | — | 152 | 43 |
| Tarpon Transmission Co. | 40 | — | — | 40 | — | — | — | — | 23,096 | 21.251 | 162 | 944 | (36) |
| Tennessee Gas Pipeline Co.* | 14,426 | 31 | 2 | 14,459 | 69 | 1 | 70 | 235,235 | 1,374,085 | 3,699,054 | 111,560 | 1,373,550 | 669,747 |
| Texas Eastern Transmission Corp.* | 9,837 | 48 | 196 | 10,081 | 71 | 8 | 79 | 525,360 | 541,221 | 3,449,830 | 361,117 | 1,975,832 | 152,991 |
| Texas Gas Pipe Line Corp. | 6 | — | — | 6 | — | — | — | 3,523 | 215 | 439 | 61 | 7,390 | 172 |
| Texas Gas Transmission Corp. * | 5,870 | 39 | 219 | 6,128 | 27 | 9 | 36 | 167,657 | 544,352 | 1,004,971 | 69,238 | 645,708 | 29.610 |
| Texas Sea Rim Pipeline Inc. | 29 | — | — | 29 | — | — | — | - | 5,810 | 15,614 | 70 | 269 | (532) |
| Trailblazer Pipeline Co. * | 436 | — | — | 436 | — | — | — | — | 59,314 | 269,218 | 12 | 37,434 | 14,152 |
| Transco Gas Supply Co. * | — | — | — | — | — | — | — | 7,576 | — | — | — | 25,192 | (4) |
| Transcontinental Gas Pipe Line Corp.* | 10,501 | 149 | 120 | 10,770 | 40 | 33 | 73 | 147,878 | 1,914,734 | 3,455,787 | 128,462 | 1,053,177 | 40,701 |
| Transwestern Pipeline Co. * | 4,463 | — | — | 4,463 | 85 | — | 85 | 99,504 | 199,122 | 694,485 | 3,167 | 490,573 | 23,606 |
| Trunkline Gas Co. * | 4,077 | 530 | 27 | 4,634 | 21 | 9 | 30 | 148,891 | 374,883 | 1,004,416 | 6,727 | 585,359 | 31,408 |
| Trunkline LNG Co. | — | — | — | — | — | — | — | — | — | 500,635 | 159 | 57,649 | (61,104) |
| U-T Offshore System * | 30 | — | — | 30 | — | — | — | — | 285,730 | 63,057 | 8 | 6,665 | 26 |
| Union Light, Heat & Power Co. | — | — | — | — | — | — | — | 11,575 | 7,772 | 92,467 | 13,247 | 192,287 | 2,644 |
| United Cities Gas Co. | 285 | — | — | 285 | — | — | — | 402,808 | 262 | 267,540 | 69,432 | 195,773 | 8,443 |
| United Gas Pipe Line Co. * | 7,291 | 2,328 | 28 | 9,647 | 29 | 13 | 42 | 60,128 | 790,315 | 1,134,147 | 22,157 | 596,262 | (119,425) |
| Valero Interstate Transmission Co. | — | — | — | — | — | — | — | 144 | 49,876 | 12,972 | 178 | 5,319 | — |
| Valley Gas Transmission Inc. | — | 200 | — | 200 | — | — | — | 565 | 4,480 | 2,977 | 13 | 1,659 | 966 |
| Viking Gas Transmission Co. (new)* | 551 | — | — | 551 | 8 | — | 8 | 11,206 | 38,546 | 77,106 | 14,225 | 36,808 | 1,505 |
| Washington Gas Light Co. | 381 | — | — | 381 | — | — | — | 130,551 | 451 | 1,015,181 | 93,343 | 764,110 | 58,192 |
| West Texas Gas Inc. | — | — | — | — | — | — | — | 827 | — | 19,939 | 730 | 25,302 | 4,221 |
| West Texas Gathering Co. | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Western Gas Interstate Co. | 191 | 50 | — | 241 | 9 | — | 9 | 3,618 | — | 8.230 | 108 | 8.562 | 454 |
| Western Transmission Corp. | — | 61 | — | 61 | — | — | — | — | 5,805 | 612 | 11 | 598 | 373 |
| Williams Natural Gas Co. * | 5,853 | 3,756 | 176 | 9,785 | 38 | 51 | 89 | 121,047 | 229,295 | 701,545 | 41,078 | 448,360 | 28,822 |
| Williston Basin Interstate Pl. Co. * | 3,071 | 825 | 152 | 4,048 | 22 | 8 | 30 | 25,846 | 55,323 | 207,481 | 3,076 | 109,166 | 5,295 |
| Wyoming Interstate Co. Ltd. * | 269 | — | — | 269 | 1 | — | 1 | — | 73,551 | 176,584 | 16 | 24,078 | 773 |
| Zenith Natural Gas Co. | 27 | 32 | — | 59 | — | 2 | 2 | 1,324 | 39 | 784 | 157 | 3,596 | 104 |
| **1989 Totals-majors (46)** | **182,401** | **55,028** | **4,256** | **241,685** | **1,332** | **741** | **2,073** | **5,556,093** | **17,152,967** | **44,154,208** | **1,724,735** | **25,914,509** | **2,135,860** |
| 1988 Totals-majors (43) | 186,723 | 62,800 | 4,542 | 254,065 | 1,232 | 884 | 2,118 | 6,383,690 | 15,665,971 | 44,018,804 | 2,140,075 | 26,740,552 | 1,415,225 |
| **1989 Totals-all** | **205,606** | **63,201** | **4,594** | **273,401** | **1,458** | **783** | **2,241** | **7,134,907** | **19,145,579** | **54,244,640** | **2,196,369** | **32,343,805** | **2,494,238** |
| 1988 Totals-all | 204,192 | 72,393 | 4,796 | 281,381 | 1,336 | 938 | 2,274 | 7,523,542 | 16,542,847 | 50,910,100 | 2,250,038 | 32,736,380 | 1,572,609 |

Source: FERC Forms 2's and 2-A's for major and nonmajor natural-gas pipeline companies. Under critera established for the 1984 reporting year (OGJ, Nov. 25, 1985, p. 80).

Major pipeline companies are those whose combined gas sold for resale and gas transported for a fee exceeded 50 bcf at 14.73 psi (60°F.) in each of the 3 previous calendar years.

Nonmajors are natural-gas pipeline companies not classified as majors and having had total gas sales of volume transactions exceeding 200 MMcf at 14.73 psi (60°F.) in each of the 3 previous calendar years.

* Major natural-gas pipeline companies under FERC Accounting and Reporting Requirements for Natural Gas Companies, para. 20-011, effective Feb. 2, 1985, beginning with 1984 reporting year.

***THE FIRST Western style service station built from the ground up in what used to be East Germany opened this year in Dresden. It symbolizes German unification and the fading of Communist/non-Communist distinctions, a major change affecting this year's Worldwide Report.***

# Static totals mask big international changes

The only parts of Oil & Gas Journal's Worldwide Report that don't change much this year are the totals.

Estimated reserves of crude oil and lease condensate dropped fractionally to 999.1 billion bbl. Natural gas reserves increased 5.5% to 4.2 quadrillion cu ft. Production of crude and condensate rose 1.4% to 60.3 million b/d. And crude refining capacity increased fractionally to 74.6 million b/cd. But the fairly static totals mask major changes resulting from two historic developments.

One of them is the political change sweeping Eastern Europe and the U.S.S.R. Boundaries have blurred between Communist and non-Communist areas. The Worldwide list, therefore, no longer divides the world into those categories.

The other historic development is Iraq's invasion of Kuwait Aug. 2. An international embargo cut off oil exports from both countries, and the market has been adjusting ever since.

The adjustments show up in OGJ's estimates of oil production from key individual producing countries such as Saudi Arabia, Nigeria, and Venezuela. They had unused production capacity to tap to help make up for lost Iraqi and Kuwaiti supplies.

The Organization of Petroleum Exporting Countries freed them and other members from quotas in order to fill the gap. And prices $10/bbl and more above preinvasion levels provided the reason to do so.

So OPEC production—which had averaged 23.2 million b/d in July and dropped to 19.9 million b/d in August with Iraq and Kuwait off stream—bounced to 22.2 million b/d in September and 22.6 million b/d in October. The crude price jump, meanwhile, was discouraging consumption.

By November, with production increasing and demand falling, the market had reached a fragile balance. Prices remained above preinvasion levels due to fears of war and the absence of a safety margin of unused production capacity.

But even capacities were increasing. Before the invasion, key OPEC members—among them Saudi Arabia, the U.A.E., Nigeria, and Venezuela—had started or were considering long range projects to boost production capacity. The price and volume increases following the invasion promised to help them fund the buildup.

In just the 5 months since the invasion, estimated OPEC production capacity without Iraq and Kuwait has increased by about 1 million b/d to 23.4 million b/d.

Production of condensates and gas liquids by the exporters' group has increased as well. Before the invasion, output averaged 1.9 million b/d. The average dropped to 1.8 million b/d in August but later recovered and recently reached 2 million b/d.

A remaining problem is crude quality. Crudes produced to offset lost supplies are heavier than Iraqi and Kuwaiti crudes. With demand falling, some of the heavy crudes have been difficult to sell.

### Middle East patterns

The Iraqi invasion transformed patterns of production and exports from the Middle East.

Throughout the region, shut-in wells and mothballed processing equipment have been brought back into service. Saudi production, which averaged about 5.4 million b/d before the invasion, increased to 7.6 million b/d by late November.

According to reports from the Middle East, Saudi production was expected to average 8.5 million b/d in December. Saudi Arabian Oil

Worldwide
Report

Co. (Aramco) is confident that this rate can be sustained for as long as needed.

Initially, Aramco brought heavy crudes to the market. But the final 1 million b/d of incremental supply is almost entirely light and medium crudes from the kingdom's southern area fields.

By the middle of the 1990s, Saudi Arabia expects to have increased its sustainable production capacity to 10 million b/d. The kingdom bases its investment program on forecasts of increased demand for OPEC oil during the second half of the decade.

It's unlikely at present that Saudi Arabia will accelerate the program in response to the invasion.

The effects of the price jump on long term oil demand remain uncertain.

In the Neutral Zone between Saudi Arabia and Kuwait, production continues from offshore fields at about 300,000 b/d. Iraqi troops occupy the Kuwaiti-run onshore fields.

The only other country in the Persian Gulf that has boosted production since the invasion is the United Arab Emirates. Ironically, the U.A.E. had just been persuaded to toe the OPEC line on production quotas and had reduced output from 2-2.1 million b/d to 1.7 million b/d when Iraq invaded Kuwait.

Abu Dhabi, the swing U.A.E. producer, has again boosted output, pushing the total to about 2.3 million b/d. Further work, particularly onshore, was considered capable of pushing sustainable output to 2.4 million b/d by yearend.

Iran is the only other country in the Persian Gulf with the theoretical ability to increase output. However, apart from a burst in September—when output climbed to 3.4 million b/d—production has averaged 3.1-3.2 million b/d. The International Energy Agency expects Iran to have available capacity of 3.4 million b/d by the end of this year.

But there are still doubts in the industry about sustainability of production and marketability of Iran's heavy crude.

### Africa's response

Only two of OPEC's African members have been able to capitalize on the market opportunities presented by interruption in supplies from the Middle East.

Nigeria and Libya have increased output. Algeria has not been able to push production beyond 800,000 b/d, while Gabon was already producing flat-out at about 300,000 b/d.

Before the invasion Nigeria had started to formulate plans for boosting capacity to meet the expected greater call on OPEC crude in the mid-1990s. Output from the West African country was expected to be averaging 2 million b/d by the end of the year.

Libya, with the largest reserves in Africa, is also boosting output from its 1.3 million b/d average of earlier this year. Output has reached 1.4 million b/d. Industry sources estimate yearend capacity at 1.5 million b/d.

### Uncertainty in Europe

Uncertainty hovers over volumes of crude oil available from offshore Northwest Europe this winter.

U.K. offshore production, disrupted most of the year by an intensive program by all operators to install or reposition platform emergency shutdown valves, dropped to 1.6 million b/d at the end of summer. The construction work was extended by a series of unofficial strikes by contractors' personnel.

Further disruptions were expected through the final quarter of the year as the Forties and Brent pipelines were scheduled to close to accommodate new construction work.

However, the operators, BP Exploration and Shell-Expro, sought dispensations that would delay the work until the second quarter of next year, when demand for crude is lighter. That would allow U.K. output to remain at about 1.9 million b/d through winter.

Industry sources had been expecting production next year to exceed this level and average at least 1.95 million b/d. But the most recent U.K. government estimate suggested that output in 1991 would not exceed the 1.89 million b/d forecast for the whole of 1990.

Norwegian output should reach a record 1.8 million b/d this winter as high output from Statfjord field coincides with new peaks from Oseberg and Gullfaks fields and first flows from Gyda and Hod fields.

Total oil output from Danish and Dutch sectors of the North Sea remains at about 175,000 b/d.

### U.S.S.R., Eastern Europe

Although Communism faded rapidly from the global landscape in 1990, its economic wreckage remains much in evidence—nowhere more so than in the world's No. 1 producing country.

The Soviet Union's production fell below 12 million b/d this year to average an estimated 11.5 million b/d in a trend that will be difficult to reverse.

Giant fields in the two big producing areas—the Volga-Urals region and Western Siberia—are in decline. Equipment is in disrepair. Worker strikes plague the oil fields. Accidents are common.

Best near term hope for slowing the production decline is Tengiz oil field, believed to be the biggest find in the U.S.S.R. since the 1965 discovery of giant Samotlor field. A plant to handle the field's oil and gas, which contain as much as 25% hydrogen sulfide, is nearly ready for start-up.

The Soviet government's economic restructuring has diverted state investment to consumer products and away from the petroleum industry. To compensate, the government has opened the industry to foreign investment, prompting the recent rush of joint venture activity in the country. Despite the international petroleum industry's enthusiasm for Soviet geological prospects, huge problems remain. The country's economy this year has seemed headed for collapse. And Soviet republics are seeking more autonomy.

There's still no basic oil and gas law, and it's unclear what decentralization of the republics means to international companies anxious to begin work on Soviet projects. As a result, the economic lift expected from foreign investment remains at some indistinct point in the future for a country that needs help immediately. And an embargoed Iraq isn't making payments on the $80 billion it owes the U.S.S.R. for weapons used in its 8 year war with Iran.

The production slide, meanwhile, is cutting Soviet exports and, therefore, receipts of desperately needed hard currency. This year's oil export average is expected to be the lowest since the 3.33 million b/d of 1985, down from a peak of more than 4.1 million b/d in 1988.

Before the Iraqi invasion of Kuwait, the Soviet Union had begun reducing its subsidized exports of oil to former Communist satellites in Eastern Europe. So price hikes following the invasion devastated economies in that region.

### Asia-Pacific active

In contrast to those of Eastern Europe, economies in the Asia-Pacific region generally were strong when crude prices jumped in August. The region has been hurt nevertheless, mainly due to its growing dependence on imported oil.

In late September, East-West Center of Honolulu projected that if crude prices remained at about $30/bbl for 12 months and if consumption patterns didn't change, Asian net oil exporters would earn an additional $9 billion due to the Iraqi invasion. Exporters are China, Viet Nam, Brunei, Indonesia, and Malaysia.

But the oil importing countries would sustain a net increase in foreign exchange expenditures of $44 million.

All of the region's key producers scored oil production increases this year.

India, which leads the region in drilling activity, increased flow by 4.5% to an estimated 679,000 b/d, with most of the gain coming in the offshore Bombay High area.

Two state oil companies lead the activity, but India has attracted international companies to exploration in several areas. Similar efforts account for much of the production increases elsewhere in the Asia-Pacific region.

Indonesia, the area's only member of OPEC, boosted oil production by 3.5% to an estimated 1.3 million b/d this year, largely on the strength of new production from recent discoveries by international companies. But the increase is probably a temporary reversal of a decline that began after production peaked at 1.7 million b/d in 1977.

Natural production declines and rapidly growing internal demand will make it difficult for Indonesia to remain an exporter for many more years. To sustain drilling, state owned Pertamina has signed 10 production sharing contracts with foreign companies in 1988 and 19 in 1989. It expected to sign 20 this year.

Malaysia, too, has been actively signing production sharing contracts with foreign companies. Further gains are likely following this year's estimated 6.7% production increase to 605,000 b/d.

China, the biggest regional producer, managed a fractional gain to 2.755 million b/d this year. And Australia, recently liberalizing its tax regime for the Bass Strait producing region, boosted flow nearly 20% to 582,000 b/d.

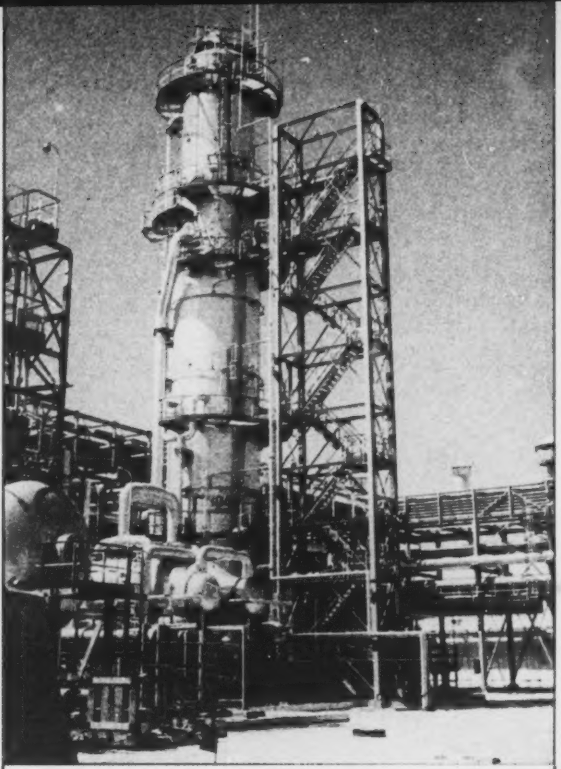
Many of the other Asia-Pacific countries have small production now but prospects for increases in the future.

Pakistan continued its steady string of production gains with a 14% increase to 60,000 b/d. Thailand gained 2% to 41,000 b/d and has been actively opening acreage to international companies.

Viet Nam doubled production to 40,000 b/d and has let at least nine production sharing contracts to foreign firms in the past few years.

Myanmar, too, has opened its doors to foreigners.

And Papua New Guinea soon will join the list of producing countries when the Hedinia area fields come on stream.



***PROCESSING PLANT will handle corrosive oil and gas production from big Tengiz field near the northeast coast of the Caspian Sea in the Soviet Union. The plant recently was undergoing precommissioning work.***

### Western Hemisphere

In the Western Hemisphere, spotty production gains in Latin America offset a 5.2% decline in the U.S. and 3.2% drop in Canada.

The biggest increase came from Venezuela—22% to an estimated average of 2.1 million b/d for the year. One of two Western Hemisphere members of OPEC, Venezuela is considering a production capacity increase to 4.2 million b/d by 1995.

Ecuador, the other OPEC member, boosted flow 3% to 287,000 b/d and continues to make acreage available to international companies. And Colombia's 445,000 b/d average this year represents a 10% increase. New pipelines have boosted production in the Upper Magdalena Valley region, and there has been some slowdown in the guerrilla activity disrupting operations of the Caño Limón pipeline.

Capital shortage plagues a number of Latin American countries with potential to produce more than at present.

Peru's oil flow held shakily at 132,000 b/d this year after several years of decline. A cash shortage has kept the country from paying service contractors, which in turn have stopped work—and production—intermittently to await payment and vital supplies.

The government recently announced an overhaul of the petroleum sector, including a cut of domestic product subsidies and a new effort to attract foreign participation in upstream and downstream projects.

Another cash-strapped country with production well below potential is Brazil. Petrobras, the state oil company, has proposed a program to boost flow to 1 million b/d by 1995 from this year's estimated 633,000 b/d.

The country has new production or discoveries in the offshore Campos and Santos basins and onshore in the Upper Amazon region. But Petrobras has been sapped by product subsidies and constitutional restrictions on foreign participation in upstream projects.

Cash problems forced Petrobras last year to scrap plans to boost flow to 1.5 million b/d later this decade. The company decided to seek a more modest increase after the Iraqi invasion of Kuwait, which shattered its longstanding hopes of profiting from a special trade relationship with Iraq.

Capital problems still hurt Mexico, which also bans foreign capital from upstream work. The country has, however, scored some recent successes in international credit markets.

Upstream work has been slow for at least 5 years due to national austerity programs. The resulting stagnation of production and rapidly rising oil imports threaten Mexico's ability to maintain exports.

Argentina has been opening acreage to foreign companies and more recently began to at least partly privatize the state oil company, Yacimientos Petroliferos Fiscales. The country's production gained 3% to 473,000 b/d this year.

### Refining activity

Worldwide refining capacity this year exceeds last year's total by 588,000 b/d.

Some of the plants listed this year in countries in Eastern Europe didn't appear in previous reports because data weren't available. Past reports did, however, include Eastern Europe country totals under Communist categories.

Outside Eastern Europe, refineries new to the list, and therefore increasing the worldwide total, are the 332,500 b/d Petromin Petrola Rabigh Refining Co. facility, which started up this year in Rabigh, Saudi Arabia; the 78,000 b/d Holborn Europa Raffinerie GmbH refinery, which had been idle and restarted in Harburg, Germany; and Iran's 190,000 b/d refinery at Abadan, which restarted after repairs to damage sustained in Iran's war with Iraq. Other regional and country capacity changes reflect changes at existing refineries. ▪

# Worldwide oil and gas at a glance

| | ESTIMATED PROVED RESERVES 1-1-91 | | OIL PRODUCTION | | | REFINING Capacity on 1-1-91 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COUNTRY | Oil (1,000 bbl) | Gas (bcf) | Producing wells* 12-31-89 | Estimated 1990 (1,000 b/d) | % change from 1989 | No. of ref. | Crude b/cd | Thermal operations b/cd | Catalytic cracking b/cd | Catalytic reforming b/cd |
| **ASIA-PACIFIC** | | | | | | | | | | |
| Australia | 1,566,163 | 15,433 | 1,024 | 582.0 | 18.8 | 10 | 705,500 | ... | 205,300 | 160,900 |
| Bangladesh | 500 | 12,700 | 10 | 0.9 | ... | 1 | 31,200 | ... | ... | 1,650 |
| Brunei | 1,350,000 | 11,200 | 556 | 143.0 | 8.0 | 1 | 10,000 | ... | ... | ... |
| China | 24,000,000 | 35,300 | 43,700 | 2,755.0 | 0.1 | 40 | 2,200,000 | ... | ... | ... |
| China, Taiwan | 4,500 | 700 | 88 | 2.5 | 8.7 | 2 | 542,500 | 17,493 | 22,600 | 51,960 |
| India | 7,997,100 | 25,049 | 1,944 | 679.0 | 4.5 | 12 | 1,122,360 | 114,875 | 136,970 | 28,233 |
| Indonesia | 11,050,000 | 91,450 | 6,963 | 1,274.0 | 3.5 | 6 | 813,600 | 81,700 | 12,600 | 61,500 |
| Japan | 63,019 | 1,124 | 368 | 10.5 | 11.7 | 41 | 4,383,400 | 76,900 | 629,975 | 607,970 |
| Korea, North | ... | ... | ... | ... | ... | 1 | 42,000 | ... | ... | ... |
| Korea, South | ... | ... | ... | ... | ... | 6 | 867,000 | 48,700 | ... | 62,450 |
| Malaysia | 2,900,000 | 56,900 | 508 | 605.0 | 6.7 | 4 | 209,500 | ... | ... | 30,300 |
| Myanmar (Burma) | 51,000 | 9,400 | 450 | 13.0 | 8.3 | 2 | 32,000 | 5,200 | ... | ... |
| New Zealand | 209,000 | 4,106 | 51 | 39.0 | 1.8 | 1 | 95,100 | ... | ... | 26,600 |
| Pakistan | 162,087 | 19,449 | 98 | 60.0 | 13.6 | 3 | 120,975 | ... | ... | 4,800 |
| Papua New Guinea | 200,000 | 8,000 | ... | ... | ... | ... | ... | ... | ... | ... |
| Philippines | 38,688 | 1,800 | 12 | 5.0 | −2.0 | 4 | 279,300 | ... | 26,900 | 37,500 |
| Singapore | ... | ... | ... | ... | ... | 5 | 878,000 | 190,700 | .... | 63,600 |
| Sri Lanka | ... | ... | ... | ... | ... | 1 | 50,000 | 12,500 | ... | 3,750 |
| Thailand | 150,000 | 5,850 | 287 | 41.0 | 2.2 | 3 | 220,550 | 17,600 | 26,100 | 27,550 |
| Viet Nam | 500,000 | 100 | N A | 40.0 | 100.0 | ... | .... | .... | .... | .... |
| **Total Asia-Pacific** | **50,242,057** | **298,561** | **56,059** | **6,249.9** | **4.1** | **143** | **12,602,985** | **565,668** | **1,060,445** | **1,168,763** |
| **WESTERN EUROPE** | | | | | | | | | | |
| Austria | 81,443 | 403 | 1,070 | 24.0 | 9.6 | 1 | 204,000 | 23,426 | 24,000 | 32,000 |
| Belgium | ... | ... | ... | ... | ... | 4 | 602,000 | 63,500 | 104,700 | 81,900 |
| Cyprus | ... | ... | ... | ... | ... | 1 | 18,600 | ... | ... | 4,300 |
| Denmark | 799,435 | 4,488 | 95 | 118.0 | 5.6 | 3 | 185,500 | 73,670 | ... | 31,100 |
| Finland | ... | ... | .. | ... | ... | 2 | 241,000 | 46,300 | 41,800 | 42,900 |
| France | 184,766 | 1,324 | 632 | 62.0 | −5.5 | 14 | 1,815,630 | 172,990 | 349,480 | 246,760 |
| Germany | 425,000 | 12,400 | 2,883 | 78.0 | −3.7 | 20 | 2,065,400 | 386,962 | 240,250 | 376,500 |
| Greece | 30,000 | 47 | 13 | 15.0 | −17.6 | 4 | 395,300 | 40,400 | 59,900 | 47,000 |
| Ireland | ... | 1,700 | ... | ... | ... | 1 | 56,000 | ... | ... | 11,000 |
| Italy | 693,503 | 11,624 | 198 | 97.0 | 16.9 | 21 | 2,385,358 | 390,450 | 306,300 | 315,050 |
| Netherlands | 157,200 | 60,900 | 188 | 71.0 | 4.4 | 7 | 1,196,700 | 160,060 | 128,000 | 182,600 |
| Norway | 7,609,412 | 60,674 | 318 | 1,574.0 | 6.8 | 3 | 288,000 | 68,000 | 41,000 | 47,000 |
| Portugal | ... | ... | ... | ... | .. | 3 | 294,300 | ... | 10,100 | 51,000 |
| Spain | 20,000 | 780 | 44 | 14.3 | −20.6 | 10 | 1,321,000 | 179,500 | 157,300 | 191,000 |
| Sweden | ... | ... | ... | ... | ... | 5 | 427,500 | 65,000 | 25,000 | 72,000 |
| Switzerland | ... | ... | ... | ... | ... | 2 | 132,000 | 20,000 | ... | 26,000 |
| Turkey | 650,000 | 1,150 | 653 | 70.0 | 25.0 | 5 | 728,644 | 4,177 | 40,575 | 66,557 |
| United Kingdom | 3,825,000 | 19,775 | 762 | 1,860.0 | 4.9 | 15 | 1,866,940 | 146,000 | 444,500 | 366,300 |
| **Total Western Europe** | **14,475,759** | **175,265** | **6,856** | **3,983.3** | **5.6** | **121** | **14,223,872** | **1,840,435** | **1,972,905** | **2,190,967** |
| **EASTERN EUROPE & U.S.S.R.** | | | | | | | | | | |
| Romania | 1,170,000 | 4,700 | N A | 160.0 | −11.1 | 13 | 617,000 | NA | NA | NA |
| U.S.S.R. | 57,000,000 | 1,600,000 | 145,000 | 11,500.0 | −5.3 | 39 | 12,300,000 | NA | NA | NA |
| Yugoslavia | 240,000 | 2,900 | 1,671 | 65.0 | −4.3 | 7 | 609,135 | 35,630 | 52,050 | 74,612 |
| Other† | 445,000 | 11,400 | N A | 81.0 | −14.7 | 25 | 1,400,454 | NA | NA | NA |
| **Total Eastern Europe & U.S.S.R.** | **58,855,000** | **1,619,000** | **146,671** | **11,806.0** | **−5.4** | **84** | **14,926,589** | **35,630** | **52,050** | **74,612** |
| **MIDDLE EAST** | | | | | | | | | | |
| Abu Dhabi | 92,200,000 | 182,800 | 1,001 | 1,587.0 | 12.9 | 2 | 192,500 | ... | ... | 30,100 |
| Bahrain | 97,460 | 6,250 | 286 | 42.0 | 7.7 | 1 | 243,000 | 20,000 | 39,000 | 18,000 |
| Dubai | 4,000,000 | 4,800 | 149 | 469.0 | 12.9 | ... | ... | ... | ... | ... |
| Iran | 92,850,000 | 600,350 | 361 | 3,120.0 | 11.4 | 5 | 720,000 | 92,500 | ... | 105,397 |
| Iraq | 100,000,000 | 95,000 | 820 | 2,083.0 | −28.1 | 8 | 318,500 | ... | ... | 43,500 |
| Israel | 1,400 | 10 | 12 | 0.3 | ... | 2 | 180,000 | 60,000 | 22,000 | 25,000 |
| Jordan | 20,000 | 400 | 4 | 0.4 | ... | 1 | 100,000 | .... | 4,410 | 8,640 |
| Kuwait | 94,525,000 | 48,600 | 363 | 1,080.0 | −32.2 | 4 | 819,000 | 54,000 | 42,000 | 33,000 |
| Lebanon | ... | ... | ... | ... | ... | 2 | 37,500 | ... | 7,250 | 7,442 |
| Neutral Zone | 5,000,000 | 10,000 | 500 | 315.0 | −20.7 | ... | ... | ... | ... | ... |
| Oman | 4,300,000 | 7,200 | 1,240 | 658.0 | 2.8 | 1 | 76,932 | ... | ... | 15,386 |
| Qatar | 4,500,000 | 163,200 | 174 | 387.0 | ... | 1 | 62,000 | ... | ... | 12,030 |
| Ras al Khaimah | 400,000 | 2,000 | 6 | 10.0 | ... | ... | ... | ... | ... | ... |
| Saudi Arabia | 257,504,000 | 180,355 | 858 | 6,215.0 | 24.4 | 8 | 1,862,500 | 71,900 | 87,541 | 183,922 |
| Sharjah | 1,500,000 | 10,800 | 20 | 35.0 | ... | ... | ... | ... | ... | ... |
| Syria | 1,700,000 | 5,500 | 963 | 385.0 | 13.2 | 2 | 237,394 | 37,285 | ... | 31,352 |
| Yemen | 4,000,000 | 7,000 | 70 | 179.0 | 0.5 | 2 | 171,500 | ... | ... | 13,300 |
| **Total Middle East** | **662,597,860** | **1,324,265** | **6,827** | **16,565.7** | **2.7** | **39** | **5,020,826** | **335,685** | **202,201** | **527,069** |

|  | ESTIMATED PROVED RESERVES 1-1-91 |  | OIL PRODUCTION |  |  | REFINING Capacity on 1-1-91 |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
| COUNTRY | Oil (1,000 bbl) | Gas (bcf) | Producing wells* 12-31-89 | Estimated 1990 (1,000 b/d) | % change from 1989 | No. of ref. | Crude | Thermal operations | Catalytic cracking | Catalytic reforming |
|  |  |  |  |  |  |  | b/cd |  |  |  |
| **AFRICA** |  |  |  |  |  |  |  |  |  |  |
| Algeria | 9,200,000 | 114,700 | 840 | 797.0 | 11.2 | 4 | 464,700 | ... | ... | 55,600 |
| Angola | 2,074,000 | 1,800 | 439 | 480.0 | 6.1 | 1 | 37,630 | ... | ... | 1,714 |
| Benin | 100,000 | ... | 6 | 4.0 | ... | ... | ... | ... | ... | ... |
| Cameroon | 400,000 | 3,880 | 175 | 164.0 | −3.0 | 1 | 42,000 | ... | ... | 7,000 |
| Congo | 830,000 | 2,580 | 312 | 161.0 | 15.6 | 1 | 21,000 | ... | ... | 2,000 |
| Egypt | 4,500,000 | 12,400 | 896 | 873.0 | 2.6 | 8 | 523,153 | 16,470 | ... | 33,540 |
| Ethiopia | ... | 880 | ... | ... | ... | 1 | 18,000 | ... | ... | 2,400 |
| Gabon | 730,000 | 490 | 310 | 269.0 | 27.5 | 1 | 24,000 | 7,200 | ... | 1,400 |
| Ghana | 500 | ... | ... | ... | ... | 1 | 26,600 | ... | ... | 6,175 |
| Ivory Coast | 100,000 | 3,500 | 13 | 2.1 | ... | 2 | 69,000 | ... | ... | 13,600 |
| Kenya | ... | ... | ... | ... | ... | 1 | 90,000 | ... | ... | 9,000 |
| Liberia | ... | ... | ... | .. | ... | 1 | 15,000 | ... | ... | 2,000 |
| Libya | 22,800,000 | 43,000 | 696 | 1,369.0 | 21.2 | 3 | 347,600 | ... | ... | 13,882 |
| Madagascar | ... | 70 | ... | ... | ... | 1 | 16,350 | 7,000 | ... | 2,600 |
| Morocco | 2,000 | 53 | 5 | 0.3 | ... | 2 | 154,600 | ... | 5,600 | 26,800 |
| Mozambique | ... | 2,290 | ... | ... | ... | ... | ... | ... | ... | ... |
| Nigeria | 17,100,000 | 87,400 | 1,432 | 1,808.0 | 8.0 | 4 | 433,250 | ... | 82,700 | 70,070 |
| Senegal | ... | ... | ... | ... | ... | 1 | 24,000 | ... | ... | 2,600 |
| Sierra Leone | ... | ... | ... | ... | ... | 1 | 10,000 | ... | ... | ... |
| Somalia | ... | 210 | ... | ... | ... | 1 | 10,000 | ... | ... | ... |
| South Africa | ... | 1,760 | ... | ... | .. | 4 | 430,500 | 72,000 | 84,400 | 62,600 |
| Sudan | 300,000 | 3,000 | ... | ... | ... | 1 | 21,700 | ... | ... | 1,900 |
| Tanzania | ... | 4,100 | ... | ... | ... | 1 | 17,000 | ... | ... | 6,700 |
| Tunisia | 1,700,000 | 3,000 | 147 | 93.0 | −9.7 | 1 | 34,000 | ... | ... | 3,300 |
| Zaire | 55,640 | 30 | 110 | 28.0 | −4.8 | 1 | 17,000 | ... | ... | 3,500 |
| Zambia | ... | ... | ... | ... | .. | 1 | 24,500 | ... | ... | 5,600 |
| **Total Africa** | **59,892,140** | **285,143** | **5,381** | **6,048.4** | **10.3** | **44** | **2,871,583** | **102,670** | **172,700** | **333,981** |
| **WESTERN HEMISPHERE** |  |  |  |  |  |  |  |  |  |  |
| Argentina | 2,280,000 | 27,000 | 10,161 | 473.0 | 3.3 | 11 | 696,285 | 164,100 | 171,300 | 41,300 |
| Barbados | 3,083 | 6 | 88 | 1.2 | 9.1 | 1 | 3,000 | ... | ... | ... |
| Bolivia | 119,182 | 4,149 | 296 | 19.2 | −3.5 | 3 | 45,250 | ... | ... | 11,300 |
| Brazil | 2,840,000 | 4,045 | 6,267 | 633.0 | 7.0 | 13 | 1,411,520 | 39,765 | 316,585 | 23,610 |
| Canad[illegible] | 5,782,949 | 97,589 | 38,794 | 1,508.0 | −3.2 | 28 | 1,882,060 | 88,978 | 387,870 | 367,060 |
| Chile | 300,000 | 4,100 | 366 | 20.3 | −1.5 | 3 | 145,800 | 19,000 | 37,870 | 10,300 |
| Colon[illegible] | 2,000,000 | 4,500 | 3,771 | 445.0 | 10.1 | 4 | 247,400 | 60,000 | 91,000 | 6,000 |
| Costa [illegible] | ... | ... | ... | ... | ... | 1 | 15,000 | 6,500 | ... | 1,200 |
| Cuba | 100,000 | 100 | N A | 15.0 | −6.3 | 4 | 280,000 | ... | ... | ... |
| Dominican Republic | ... | ... | ... | ... | ... | 2 | 48,000 | ... | ... | 9,100 |
| Ecuador | 1,420,000 | 3,950 | 947 | 287.0 | 2.9 | 5 | 141,800 | 25,200 | 16,000 | 2,780 |
| El Salvador | ... | ... | ... | ... | ... | 1 | 16,300 | ... | ... | 3,000 |
| Guatemala | 36,205 | 10 | 14 | 4.0 | 2.6 | 1 | 16,000 | ... | ... | 3,000 |
| Honduras | ... | ... | ... | ... | ... | 1 | 14,000 | ... | ... | 1,800 |
| Jamaica | ... | ... | ... | ... | ... | 1 | 34,200 | ... | ... | 3,240 |
| Martinique | ... | ... | ... | ... | ... | 1 | 12,000 | ... | ... | 3,000 |
| Mexico | 51,983,000 | 72,744 | 4,740 | 2,633.0 | 0.8 | 9 | 1,679,000 | 82,000 | 267,000 | 157,800 |
| Netherlands Antilles | ... | ... | ... | ... | ... | 1 | 320,000 | 67,000 | 42,000 | 15,000 |
| Nicaragua | ... | ... | ... | ... | ... | 1 | 16,000 | ... | ... | 3,000 |
| Panama | ... | ... | ... | ... | ... | 1 | 100,000 | ... | ... | 7,500 |
| Paraguay | ... | ... | ... | ... | ... | 1 | 7,500 | ... | ... | ... |
| Peru | 405,937 | 7,082 | 3,536 | 132.0 | ... | 6 | 188,820 | ... | 24,600 | 1,760 |
| Puerto Rico | ... | ... | ... | ... | ... | 2 | 125,000 | ... | 12,000 | 25,500 |
| Suriname | 27,300 | ... | 124 | 4.0 | 5.3 | ... | ... | ... | ... | ... |
| Trinidad & Tobago | 536,000 | 8,910 | 3,199 | 151.0 | 1.1 | 2 | 246,000 | 8,000 | 26,000 | 14,400 |
| Uruguay | ... | ... | ... | ... | ... | 1 | 33,000 | ... | 4,100 | 2,500 |
| Venezuela | 59,040,000 | 105,688 | 12,752 | 2,118.0 | 22.4 | 6 | 1,167,000 | 134,100 | 139,000 | 6,000 |
| Virgin Islands | ... | ... | ... | ... | ... | 1 | 545,000 | 80,000 | ... | 125,000 |
| United States | 26,177,000 | 166,208 | 603,365 | 7,220.0 | −5.2 | 190 | §15,558,923 | §1,972,400 | §5,404,100 | §3,930,470 |
| **Total Western Hemisphere** | **153,050,656** | **506,081** | **688,420** | **15,663.7** | **0.5** | **301** | **24,994,858** | **2,747,043** | **6,939,425** | **4,775,620** |
| **TOTAL WORLD** | **999,113,472** | **4,208,315** | **910,214** | **60,317.0** | **1.4** | **732** | **74,640,713** | **5,627,131** | **10,399,726** | **9,071,012** |

EDITOR'S NOTE: All reserves figures except those for the U.S.S.R. (and gas for Canada) are reported as proved reserves recoverable with present technology and prices. U.S.S.R. figures are "explored reserves" which include proved, probable, and some possible. Canadian gas figure, under criteria adopted by Canadian Petroleum Association in 1980, includes proved and some probable. *Does not include shut-in, injection, or service wells. †Includes Albania, Bulgaria, Czechoslovakia, Hungary, and Poland. §Estimates based on capacity as of Jan. 1, 1990.

# Worldwide Production

- Offshore (e) Estimated (c) Condensate (NA) Not available

WORLDWIDE PRODUCTION

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **ABU DHABI(e)** | ADCO, OTHERS | Asab, 1965 | 8,000- 8,700 | 106 | 248 | 1,405,600 | 9,391,306,800 | 40.8 |
| | | Bab, 1958 | 8,600- 9,300 | 100 | 232 | | | 40.6 |
| | | Bu Hasa, 1962 | 8,300- 9,200 | 201 | 371 | | | 39.0 |
| | | Sahil, 1967 | 9,500- 9,800 | 22 | 52 | | | 39.7 |
| | | • Umm Shaif, 1958 | 9,800-12,000 | 142 | 203 | | | 37.0 |
| | | • Zakum Lower, 1963 | 8,000-9,000 | 131 | 254 | | | 39.0 |
| | | • Zakum Upper, 1963 | 7,000-8,000 | 142 | 262 | | | 35.0 |
| | | • Umm Addalkh, 1969 | 7,700-8,500 | 32 | 54 | | | 32.5 |
| | | • Satah, 1975 | 8,550-9,500 | 10 | 21 | | | 39.8 |
| | | • Arzanah, 1973 | 11,000-11,300 | 14 | 34 | | | 44.6 |
| | | • Abu Al Bukhoosh, 1969 | 8,900-10,900 | 42 | 48 | | | 32.0 |
| | | • Mubarraz, 1969 | 8,300-10,000 | 28 | 28 | | | 37.0 |
| | | • Bunduq, 1964 | 9,400-10,900 | 23 | 40 | | | 40.0 |
| | | **Total Abu Dhabi** | | 1,001 | 1,883 | 1,405,600 | 9,391,306,800 | |
| **ALGERIA(e)** | SONATRACH | Zarzaitine, 1957 | 4,700 | 840 | 840 | 714,000 | 8,032,996,000 | 42.2 |
| | | Edjeleh, 1956 | 1,500- 2,800 | | | | | 37.2 |
| | | Tiguentourine, 1966 | 2,160- 4,265 | | | | | 44.4 |
| | | El Adeb Lareche, 1958 | 4,100 | | | | | 43.3 |
| | | Assakaifaf N. & S., 1958 | 2,800 | | | | | 42.7 |
| | | Tan Emellel N. & S., 1960 | 2,800- 4,500 | | | | | 42.5 |
| | | Edeyen, 1964 | 5,580 | | | | | 41.5 |
| | | Hassi Mazoula S., 1963 | 4,430 | | | | | 40.2 |
| | | Hassi Mazoula B., 1965 | 4,920 | | | | | 42.0 |
| | | Acheb W. & Kreb, 1963 & 1960 | 7,360 | | | | | 45.6 |
| | | Tin Fouye N. +F6, 1962 | 4,265 | | | | | 39.6 |
| | | El Borma, 1967 | 8,200 | | | | | 42.9 |
| | | Keskassa, 1968 | 8,860 | | | | | 42.9 |
| | | Mereksen, 1974 | 9,420 | | | | | 45.8 |
| | | Gara, 1962 | 9,420 | | | | | 42.9 |
| | | Hassi Messaoud N., 1956 | 10,500 | | | | | 45.9 |
| | | Hassi Messaoud S., 1956 | 10,500 | | | | | 46.1 |
| | | Gassi-Touil & Gassi-Touil E., 1961 | 6,890 | | | | | 50.6-50.8 |
| | | Hassi Chergui | 8,200 | | | | | 50.6 |
| | | Nezla N., 1965 | 8,530 | | | | | 51.5 |
| | | Rhourde El Baguel, 1962 | 9,850 | | | | | 40.2 |
| | | Mesdar E. & W., 1972 | 11,155 | | | | | 40.3 |
| | | El Gassi-El Agreb, 1959 | 10,170 | | | | | 47.9 |
| | | Rhourde Nouss & E., 1972 | 8,530 | | | | | 39.7 |
| | | Tin Foye Tabankort, 1966 | 4,600- 6,560 | | | | | 41.1-41.3 |
| | | Djoua W., 1967 | 5,580- 6,240 | | | | | 41.1 |
| | | Amassak, 1970 | 6,565 | | | | | 41.1 |
| | | Tamendjelt, 1970 | 5,585- 6,890 | | | | | 41.1 |
| | | Timedratine, 1964 | 8,155 | | | | | 42.7 |
| | | Ohanet N. & S., 1960 | 7,878 | | | | | 43.8 |
| | | Askarene, 1962 | 8,200 | | | | | 41.7 |
| | | Guelta, 1962 | 8,960 | | | | | 41.7 |
| | | Stah, 1971 | 9,515 | | | | | 45.8 |
| | | Ras Toumb, 1976 | 9,190 | | | | | 35.7 |
| | | Haoud Berkaoui-Ben Kahla, 1965 | 11,000 | | | | | 43.6 |
| | | Guellala-Guellala N.E., 1969 | 11,320 | | | | | 42.2-42.3 |
| | | N'Goussa, 1974 | 11,715 | | | | | 42.2 |
| | | Kef El Argoub, 1973 | 12,570 | | | | | 42.2 |
| | | Oued Noumer, 1969 | 8,860 | | | | | 48.3 |
| | | Djorf, 1974 | 9,025 | | | | | 48.3 |
| | | Djebel Onk, 1960 | 3,940 | | | | | 37.0 |
| | | Alrar FJT | ... | | | | | ... |
| | | Hassi R'Mel(c) | ... | | | | | ... |
| | | Gassi Touil(c) | ... | | | | | ... |
| | | **Total Algeria** | | 840 | 840 | 714,000 | 8,032,996,000 | |
| **ANGOLA** | FINA ANGOLA | Benfica, 1955 | 8,300 | 2 | 15 | 22 | 2,272,000 | 30.0 |
| | | Bento, 1972 | 7,350 | 1 | 5 | 225 | 5,075,000 | 36.0 |
| | | C. Cobra, 1969 | 4,000 | 11 | 15 | 1,056 | 3,795,000 | 41.0 |
| | | Cacuaco, 1958 | 7,870 | 1 | 12 | 38 | 279,000 | 30.0 |
| | | Galinda, 1959 | 7,220 | ... | 8 | ... | 2,245,000 | 30.0 |
| | | Ganda, 1975 | 5,000 | 8 | 9 | 4,096 | 8,497,000 | 36.0 |
| | | Legua, 1972 | 6,300 | 1 | 3 | 96 | 732,000 | 31.0 |
| | | Luango, 1977 | 3,800 | 3 | 6 | 955 | 2,555,000 | 38.0 |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Lumueno, 1977 | 4,600 | 9 | 13 | 2,341 | 5,610,000 | 37.0 |
| | | Mulenvos, 1966 | 5,900- 6,600 | 7 | 16 | 267 | 5,750,000 | 25.0 |
| | | N'Zombo, 1973 | 5,000- 6,300 | 24 | 41 | 9,882 | 95,213,000 | 33.0 |
| | | Pambo, 1982 | 4,600 | 4 | 5 | 1,096 | 2,434,000 | 39.0 |
| | | Pinda, 1966 | 6,709 | ... | 4 | ... | 3,000 | 26.0 |
| | | Quenguela, 1968 | 6,000 | 26 | 68 | 1,164 | 38,058,000 | 31.0 |
| | | Quinfuquena, 1975 | 6,800- 7,100 | 14 | 19 | 4,223 | 27,428,000 | 32.0 |
| | | Quinguila, 1972 | 3,400 | 18 | 58 | 7,375 | 38,732,000 | 36.0 |
| | | Sereia, 1974 | 6,200 | 2 | 4 | 812 | 1,735,000 | 27.0 |
| | | Tobias, 1961 | 1,970 | 1 | 6 | 50 | 28,846,000 | 31.0 |
| | CHEVRON | • Kali, 1969 | 11,400-11,660 | 1 | 1 | 120 | 4,334,230 | 30.0 |
| | | • Kambala, 1971 | 10,500 | 4 | 5 | 5,430 | 21,778,134 | 32.8 |
| | | • Kungulo, 1975 | 4,000 | 16 | 17 | 9,846 | 50,196,610 | 32.2 |
| | | • Lifuma, 1984 | 7,800 | ... | 1 | 15 | 205,368 | 31.4 |
| | | • Limba, 1969 | 2,660- 7,350 | 10 | 14 | 10,542 | 92,672,296 | 31.6 |
| | | • Livuite, 1979 | 8,000 | 3 | 7 | 406 | 2,796,577 | 31.7 |
| | | • Malongo North, 1966 | 1,170- 9,250 | 53 | 61 | 14,533 | 220,826,849 | 30.0 |
| | | • Malongo South, 1966 | 1,150- 1,440 | 26 | 29 | 7,514 | 78,253,055 | 28.0 |
| | | • Malongo West, 1969 | 1,680- 8,800 | 25 | 35 | 19,895 | 244,753,554 | 22.5 |
| | | • Numbi, 1980 | 3,446 | 24 | 26 | 46,044 | 36,341,483 | 34.0 |
| | | • Takula, 1971 | 3,070- 9,090 | 66 | 72 | 103,661 | 235,651,419 | 31.5 |
| | | • Vuko, 1983 | 3,700 | 3 | 6 | 7,049 | 12,574,990 | 35.0 |
| | | • Wamba, 1982 | 2,700 | 7 | 7 | 29,023 | 30,144,650 | 29.0 |
| | TEXACO-SONANGOL-TOTAL-BRASPETRO | • Cuntala, 1978 | 7,200 | ... | 1 | ... | 4,420,000 | 31.0 |
| | | • Essungo, 1975 | 6,500 | 8 | 10 | 3,575 | 39,795,000 | 35.0 |
| | | • Lombo Este, 1983 | 7,800 | 9 | 10 | 19,740 | 13,130,000 | 41.0 |
| | | • Suleie Oeste, 1985 | 7,600 | 6 | 6 | 2,986 | 2,630,000 | 41.0 |
| | | • Sulele South 1, 1986 | 7,600 | 1 | 3 | 1,712 | 1,085,000 | 39.0 |
| | | • Tubarão, 1984 | 7,600 | 6 | 7 | 11,164 | 7,800,000 | 41.0 |
| | ELF ANGOLA(e) | • Palanca, 1982 | 11,500 | 39 | 39 | 125,677 | 145,391,043 | 38.0 |
| | | • Pacassa, 1981 | 8,860 | | | | | 40.0 |
| | | **Total Angola** | | **439** | **664** | **452,630** | **1,513,439,258** | |
| **ARGENTINA** | YPF(e) | Chubut, 1907 | 1,908- 9,168 | 2,261 | 2,325 | 416,266 | 4,705,331,768 | 21.1-26.0 |
| | | Formosa, 1984 | 11,466-11,490 | 12 | 14 | | | 42.0-42.9 |
| | | Jujuy, 1969 | 2,461-16,732 | 9 | 9 | | | 46.5-47.0 |
| | | La Pampa, 1968 | 3,609- 4,921 | 198 | 209 | | | 31.0 |
| | | Mendoza, 1932 | 2,178-16,778 | 1,156 | 1,187 | | | 23.7-32.0 |
| | | Neuquen, 1918 | 1,312-12,498 | 1,160 | 1,205 | | | 24.0-41.0 |
| | | Rio Negro, 1960 | 2,953- 7,546 | 897 | 937 | | | 22.5-41.0 |
| | | Salta, 1928 | 6,551-15,092 | 33 | 43 | | | 29.0-59.0 |
| | | Santa Cruz, 1946 | 1,468-17,060 | 3,129 | 3,274 | | | 21.1-30.0 |
| | | Tierra del Fuego, 1959 | 5,249- 7,824 | 206 | 206 | | | 43.4-46.0 |
| | AMOCO | Cerro Dragon, 1958 | 7,200 | 1,100 | 1,600 | 41,734 | 439,469,000 | 21.0 |
| | | **Total Argentina** | | **10,161** | **11,009** | **458,000** | **5,144,800,768** | |
| **AUSTRALIA** | BARRACK ENERGY | Mount Horner, 1965 | 3,800- 5,800 | 7 | 12 | 360 | 219,165 | 38.0 |
| | BHP PETROLEUM PTY. LTD | • Jabiru, 1983 | 4,786 | 4 | 4 | 40,800 | 36,144,789 | 42.3 |
| | | • Challis/Cassini, 1984 | 5,000 | 7 | 7 | 24,348 | 535,666 | 39.5 |
| | HADSON ENERGY LTD. | • Harriet, 1983 | 6,230 | 10 | 10 | 11,200 | 14,253,000 | 38.2 |
| | AGL PETROLEUM | Alton, 1964 | 6,000 | 4 | 8 | 29 | 1,909,000 | 49.5 |
| | | Anabranch, 1965 | 4,188 | ... | ... | ... | 13,718 | 44.0 |
| | | Bennett, 1965 | 5,960 | 1 | 1 | 4 | 118,592 | 45.0 |
| | | Cabawin, 1961 | 10,800 | 1 | 1 | 3 | 62,337 | 49.0 |
| | | Maffra, 1965 | 4,251 | 1 | 1 | 14 | 38,162 | 48.0 |
| | | Mereenie, 1964 | 4,000 | 24 | 37 | 1,737 | 4,605,023 | 48.9 |
| | | Merrit, #1, 1985 | 4,521 | 1 | 1 | 47 | 50,154 | 51.0 |
| | | Moonie, 1961 | 5,800 | 20 | 38 | 560 | 22,103,380 | 44.5 |
| | | Richmond, 1963 | 3,643 | ... | ... | ... | 16,345 | 43.0 |
| | | Snake Creek, 1964 | 4,990 | ... | ... | ... | 13,158 | 67.0 |
| | | Sunny Bank, 1962 | 6,139 | ... | ... | ... | 706 | 40.0 |
| | | Trinidad 1 & 3, 1965 | 4,599 | ... | ... | ... | 63,560 | 46.0 |
| | AMPOLEX (PPL) PTY. LTD. | Cranstoun, 1987 | 4,250 | 1 | 1 | 179 | 169,556 | 48.0 |
| | | Endeavour, 1989 | 5,085 | 1 | 1 | 202 | 9,494 | 49.7 |
| | | Ipundu, 1986 | 2,700 | 1 | 1 | 53 | 86,636 | 43.0 |
| | | Ipundu, North, 1989 | 4,354 | 1 | 1 | 25 | 1,055 | 49.7 |
| | | Monler, 1987 | 4,150 | 2 | 2 | 24 | 36,330 | 49.0 |
| | | Talgeberry, 1985 | 3,900 | 2 | 3 | 113 | 334,701 | 46.0 |
| | | Takyah, 1985 | 3,800 | 1 | 1 | 15 | 20,874 | 43.0 |
| | | Tarbat, 1988 | 2,700 | 1 | 1 | 7 | 13,648 | 43.0 |
| | | Tintaburra, 1984 | 3,500 | 5 | 6 | 271 | 643,194 | 43.0 |
| | | Toobunyah, 1985 | 3,500 | 4 | 5 | 241 | 403,172 | 43.0 |
| | EROMANGA ENERGY | Blina, 1981 | 4,300 | 5 | 5 | 236 | 1,263,829 | 37.0 |
| | | Lloyd, 1987 | 4,806 | 1 | 1 | 87 | 113,836 | 37.0 |
| | | Sundown, 1983 | 3,600 | 2 | 2 | 25 | 189,868 | 39.0 |
| | | West Terrace, 1985 | 3,800 | 2 | 2 | 35 | 135,648 | 33.0 |

| | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|
| | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **SANTOS LTD.** | Alwyn, 1985 | 5,200 | 2 | 2 | 88 | 137,000 | 41.0 |
| | Big Lake, 1984 | 6,600 | 2 | 3 | 133 | 419,000 | 45.0-48.0 |
| | Bogala, 1984 | 6,900 | 2 | 2 | 210 | 381,000 | 40.0 |
| | Bookabourdie, 1985 | 7,000 | 2 | 2 | 39 | 94,000 | 46.0 |
| | Broiga, 1983 | 9,547 | 1 | 1 | ... | 48,100 | 53.0 |
| | Challum, 1983 | ... | ... | 1 | ... | 21,000 | ... |
| | Chookoo, 1985 | 6,000 | 4 | 8 | 771 | 649,000 | 45.0 |
| | Cook, 1985 | ... | ... | 1 | ... | 29,000 | ... |
| | Corella, 1989 | ... | 1 | 1 | 18 | 3,000 | ... |
| | Cooroo/Cooroo North, 1986 | ... | 4 | 5 | 1,039 | 1,239,000 | ... |
| | Dingera, 1987 | ... | ... | 1 | ... | 1,000 | ... |
| | Dirkala, 1986 | 7,000 | 1 | 1 | 108 | 572,000 | 56.0 |
| | Dullingari, 1979 | 5,200 | 15 | 31 | 1,909 | 8,448,000 | 54.0 |
| | Fly Lake, 1971 | 9,300 | 1 | 3 | ... | 502,500 | 53.0 |
| | Gidgealpa, 1984 | 6,150 | 13 | 13 | 2,276 | 3,770,000 | 45.0-50.0 |
| | Gidgee, 1989 | ... | 1 | 1 | 16 | 6,000 | ... |
| | Gunna, 1983 | 6,000 | 1 | 1 | 18 | 83,000 | 40.0 |
| | James, 1989 | ... | 1 | 1 | 12 | 4,000 | ... |
| | Jackson, 1981 | 4,750 | 35 | 36 | 9,030 | 27,774,000 | 40.0-48.0 |
| | Jackson South, 1982 | 4,800 | 5 | 8 | 575 | 2,331,000 | 40.0 |
| | Jena, 1985 | 5,200 | 4 | 4 | 220 | 162,000 | 41.0 |
| | Kercummura, 1985 | ... | ... | 1 | ... | 1,000 | 50.8 |
| | Kerinna, 1984 | 4,300 | ... | 1 | 3 | 18,000 | 41.0 |
| | Limestone Creek/Biala, 1984 | 5,100 | 10 | 11 | 931 | 1,695,000 | 41.0 |
| | Mawson, 1987 | ... | 1 | 1 | 55 | 106,000 | ... |
| | McKinlay, 1985 | 5,100 | 1 | 2 | 6 | 33,000 | 41.0 |
| | Meranji, 1985 | 5,660 | 3 | 3 | 142 | 433,000 | 1.0 |
| | Merrimelia, 1983 | 5,250- 7,070 | 10 | 11 | 1,958 | 4,073,000 | 5.5 |
| | Mooliampah, 1985 | 6,000 | 2 | 2 | 110 | 117,000 | ... |
| | Moorari, 1971 | 7,705- 9,400 | 6 | 6 | ... | 1,598,000 | 6.9 |
| | Munro, 1988 | ... | 2 | 2 | 154 | 96,000 | ... |
| | Muteroo, 1985 | 6,000 | 5 | 5 | 1,479 | 2,507,000 | 5.0 |
| | Naccowlah, 1989 | ... | 1 | 1 | 25 | 9,000 | ... |
| | Naccowlah East, 1988 | ... | 1 | 1 | ... | ... | ... |
| | Naccowlah South, 1983 | 6,000 | 9 | 10 | 831 | 2,608,000 | 0.0-46.0 |
| | Naccowlah West, 1983 | 5,700 | 9 | 9 | 1,319 | 2,580,000 | ... |
| | Narcoonowie, 1983 | 6,000 | 2 | 2 | 106 | 193,000 | 2.0-53.0 |
| | Natan | ... | 1 | 1 | 36 | 16,000 | ... |
| | Nungaroo, 1985 | 4,150 | 1 | 1 | 21 | 58,000 | ... |
| | Pinaroo, 1889 | ... | 1 | 1 | 53 | 19,000 | ... |
| | Pintari North, 1988 | ... | 1 | 1 | 35 | 33,000 | ... |
| | Pitchery, 1988 | ... | 1 | 1 | 79 | 77,000 | ... |
| | Sigma, 1983 | 5,700 | 2 | 2 | 140 | 164,000 | ... |
| | Spencer, 1986 | 6,500 | 6 | 6 | 1,393 | 1,588,000 | 7.0 |
| | Strzelecki, 1978 | 5,800 | 15 | 17 | 2,902 | 13,719,000 | 3.0-49.0 |
| | Sturt, 1988 | ... | 4 | 4 | 515 | 217,000 | ... |
| | Sturt East | ... | 4 | 4 | 1,862 | 687,000 | ... |
| | Taloola, 1988 | ... | 2 | 2 | 535 | 317,000 | ... |
| | Tantanna, 1988 | ... | 4 | 4 | 3,719 | 1,672,000 | ... |
| | Tickalara, 1984 | 5,600 | 5 | 5 | 1,123 | 830,000 | ... |
| | Tinpilla, 1983 | 6,000 | 1 | 1 | 22 | 87,000 | ... |
| | Tirrawarra, 1970 | 9,500 | 29 | 40 | ... | 11,564,300 | 2.0 |
| | Toby, 1987 | ... | ... | 1 | ... | 25,000 | ... |
| | Ulandi, 1985 | 5,200 | 3 | 3 | 154 | 153,000 | 0.4 |
| | Wandilo, 1989 | ... | 2 | 2 | 106 | 39,000 | ... |
| | Wancoocha, 1984 | 6,000 | 3 | 6 | 344 | 1,400,000 | 4.0-54.0 |
| | Watson, 1985 | ... | 2 | 2 | 231 | 251,000 | ... |
| | Watson South, 1985 | 5,500 | 2 | 2 | 643 | 1,006,000 | 40.0 |
| | Wilson, 1983 | 5,000 | 5 | 6 | 289 | 508,000 | ... |
| | Woolkina, 1982 | 9,700 | 1 | 2 | ... | 101,900 | 1.5 |
| | Yanda, 1984 | 8,000 | 1 | 1 | 18 | 63,000 | ... |
| **WAPET GROUP** | Barrow Island, 1964 | 1,200- 6,700 | 412 | 539 | 15,232 | 236,544,108 | 37.7 |
| | Dongara, 1969 | 5,250- 5,577 | 1 | 9 | 31 | 977,414 | 35.5 |
| | Thevenard Island, 1985 | 4,600- 5,750 | 7 | 7 | 25,848 | 1,163,165 | 48.2 |
| **WOODSIDE** | ● North Rankin,(c) 1972 | 9,800 | 13 | 18 | 23,200 | 25,950,000 | 52.3 |
| **COMMAND** | Dilkera, 1989 | 3,447 | 1 | 2 | 15 | 1,781 | 46.0 |
| | Fairymount, 1985 | 6,730 | 5 | 6 | 485 | 446,044 | 50.5 |
| | Kihee, 1986 | 3,200 | ... | 2 | ... | 813 | 44.7 |
| | Koora, 1985 | 4,822 | ... | 1 | ... | 952 | 41.0 |
| | Maxwell, 1987 | 2,930 | 3 | 3 | 204 | 187,826 | 47.2 |
| | Mindagabie, 1987 | 5,290 | ... | 1 | ... | 658 | 10.3 |
| | Muthero, 1989 | 3,448 | 2 | 2 | 81 | 8,184 | 44.4 |
| | Nockatunga, 1983 | 3,310 | 3 | 5 | 120 | 338,187 | 48.0 |
| | Thungo, 1986 | 3,345 | 4 | 4 | 218 | 290,935 | 46.8 |
| | Winna, 1985 | 3,300 | 2 | 2 | 60 | 126,034 | 15.8 |
| **ESSO-BHP** | ● Barracouta, 1965 | 4,550 | 7 | 10 | 2,260 | 35,083,000 | 62.8 |
| | ● Bream, 1969 | 6,200 | 15 | 16 | 19,770 | 9,240,000 | 44.0 |
| | ● Cobia, 1972 | 7,700 | 9 | 13 | 26,420 | 86,058,000 | 44.6 |
| | ● Flounder, 1968 | 8,200 | 18 | 22 | 20,040 | 26,764,000 | 46.7 |
| | ● Fortescue, 1978 | 7,700 | 17 | 29 | 56,050 | 191,325,000 | 43.0 |
| | ● Halibut, 1967 | 7,700 | 11 | 19 | 38,930 | 722,308,000 | 43.3 |

| | | Name of field, discovery date | Depth, ft | No. of wells Producing | No. of wells Total | Production 1989 average B/d | Production Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|---|---|---|---|---|---|---|---|---|
| | | ● Kingfish, 1967 | 7,500 | 20 | 35 | 39,720 | 966,306,000 | 46.9 |
| | | ● Mackerel, 1969 | 7,700 | 14 | 18 | 42,690 | 389,364,000 | 45.6 |
| | | ● Marlin, 1966 | 5,100 | 19 | 24 | 10,940 | 62,201,000 | 50.0 |
| | | ● Snapper, 1968 | 4,350 | 11 | 27 | 6,480 | 16,272,000 | 47.0 |
| | | ● Tuna, 1968 | 6,500 | 12 | 18 | 7,060 | 37,754,000 | 40.5 |
| | | ● West Kingfish, 1968 | 7,500 | 14 | 19 | 35,540 | 83,883,000 | 46.9 |
| | | ● Whiting, 1983 | 4,800 | 4 | 5 | 1,630 | 596,000 | 53.0 |
| | **MARATHON AUST** | ● Talisman, 1984 | 9,600 | 1 | 1 | 7,334 | 3,473,446 | 41.0 |
| | **OIL COMPANY OF AUSTRALIA** | Riverslea, 1981 | 4,950 | 2 | 2 | 69 | 358,031 | 37.0 |
| | | Bora Creek, 1982 | 4,900 | 1 | 1 | 6 | 17,318 | 34.0 |
| | | Kincora, 1980 | 4,700 | 1 | 1 | ... | 304,131 | 34.0 |
| | | Sandy Creek, 1982 | 4,900 | ... | ... | ... | 8,730 | 34.0 |
| | | Waratah, 1982 | 5,350 | 3 | 4 | 42 | 299,315 | 34.0 |
| | | Washpool, 1985 | 5,250 | 1 | 1 | 2 | 2,145 | 35.0 |
| | **LASMO**(e) | Black Stump, 1986 | 5,360 | 1 | 1 | | | |
| | | Bodalla South, 1984 | 4,800- 5,230 | 6 | 6 | | | |
| | | Glenvale, 1985 | 3,800 | ... | 1 | | | |
| | | Kenmore, 1985 | 4,600- 4,980 | 10 | 11 | | | |
| | **BRIDGE OIL LTD.**(e) | Boggo Creek, 1980 | 5,320 | ... | 1 | | | 46.0 |
| | | Louise, 1986 | 5,910 | 1 | 2 | | | 58.0 |
| | | Narrows, 1986 | 5,739 | 1 | 1 | 4,000 | 9,850,000 | 60.0 |
| | | Taylor, 1988 | 5,538 | 5 | 5 | | | 47.0 |
| | | Thomby Creek, 1979 | 5,170 | ... | 4 | | | 50.0 |
| | | Waggamra, 1978 | 7,670 | 1 | 1 | | | 55.0 |
| | | Yellow Bank Creek, 1982 | 5,180 | 2 | 2 | | | 52.0 |
| | **STRATA OIL**(e) | Woodada,(c) 1980 | 7,400 | ... | ... | | | 54.0 |
| | **WESTERN MINING CORP.**(e) | ● North Herald, 1982 | 3,937 | 1 | 1 | | | 44.0 |
| | | ● South Pepper, 1982 | 4,036 | -1 | | | | 44.0 |
| | | **Total Australia** | | 4,024 | 1,363 | 502,883 | 3,088,069,926 | |
| **AUSTRIA** | **MOBIL/SHELL** | Gaiselberg, 1938 | 5,200 | 32 | 65 | 709 | 32,651,157 | 27.0 |
| | | Kemating, 1979 | 6,100 | 8 | 9 | 705 | 4,248,509 | 34.0 |
| | | Sattledt, 1971 | 5,700 | 11 | 20 | 607 | 5,449,472 | 37.0 |
| | | Other | ... | 62 | 158 | 1,518 | 46,927,432 | 33.0 |
| | **OEMV**(e) | Hochleiten, 1977 | 3,100- 5,000 | | | | | 21.3 |
| | | Matzen, 1949 | 6,100 | | | | | 25.7 |
| | | Pirawarth, 1957 | 1,600- 6,500 | 957 | 1,255 | 18,399 | 590,199,421 | 28.4 |
| | | St. Ulrich, 1938 | 1,600- 4,300 | | | | | 31.1 |
| | | **Total Austria** | | 1,070 | 1,507 | 21,938 | 679,475,991 | |
| **BAHRAIN** | **BANOCO** | Awali, 1932 | 1,850- 4,600 | 286 | 358 | 39,034 | 813,600,000 | 33.0 |
| | | **Total Bahrain** | | 286 | 358 | 39,034 | 813,600,000 | |
| **BARBADOS** | **BARB. NOC** | Woodbourne, 1966 | 1,732- 6,701 | 88 | 142 | 1,066 | 5,406,678 | 27.2 |
| | | **Total Barbados** | | 88 | 142 | 1,066 | 5,406,678 | |
| **BENIN**(e) | **WILLIAMS BROTHERS ENGINEERING** | ● Seme, 1968 | 6,232 | 6 | 6 | 4,000 | 14,814,000 | ... |
| | | **Total Benin** | | 6 | 6 | 4,000 | 14,814,000 | |
| **BOLIVIA** | **YPFB** | Camiri, 1927 | 3,936 | 43 | 54 | 362 | 48,587,297 | 55.0 |
| | | Carand, 1960 | 3,940 | 33 | 43 | 299 | 54,359,920 | 60.0 |
| | | Cascabel, 1985 | 11,319 | 1 | 1 | 261 | 229,361 | 45.6 |
| | | Colpa, 1961 | 9,184 | 11 | 15 | 154 | 18,284,329 | 65.0 |
| | | Espino, 1979 | 14,655 | ... | 3 | ... | 966,307 | 56.2 |
| | | H. Suarez R., 1982 | 7,820 | ... | 3 | ... | 486,650 | 35.0 |
| | | La Pena, 1965 | 8,856 | 26 | 31 | 4,966 | 28,619,039 | 43.0 |
| | | Monteagudo, 1966 | 4,592 | 20 | 25 | 1,326 | 32,581,324 | 41.0 |
| | | Naranjillos, 1964 | 4,806 | 12 | 14 | 128 | 92,754 | 65.3 |
| | | Palmar, 1964 | 10,758 | 3 | 5 | 82 | 1,746,131 | 65.0 |
| | | Rio Grande, 1961 | 9,512 | 35 | 43 | 1,905 | 61,459,486 | 62.0 |
| | | San Roque, 1981 | 7,170 | 8 | 8 | 1,739 | 1,350,869 | 71.0 |
| | | Santa Cruz, 1986 | 9,350 | 8 | 9 | 540 | 1,739,272 | 65.0 |
| | | Sirari, 1985 | 13,999 | 3 | 3 | 707 | 313,732 | 65.3 |
| | | Tita, 1976 | 6,450 | 7 | 7 | 82 | 4,408,595 | ... |
| | | Vibora, 1988 | 12,949 | 3 | 3 | 632 | 328,384 | 57.7 |
| | | Villamontes, 1987 | 9,770 | 2 | 3 | 354 | 554,980 | 57.0 |
| | | Vuelta Grande, 1978 | 8,220 | 16 | 18 | 2,448 | 3,273,748 | 67.0 |
| | | Other | ... | 50 | 73 | 619 | 31,214,320 | ... |
| | **OCCIDENTAL** | Porvenir, 1978 | 9,600 | 5 | 9 | 2,011 | 11,967,963 | 60.5 |
| | **TESORO BOLIVIA PETROLEUM CO.** | Escondido, 1980 | 11,293 | 3 | 6 | 5 | 1,862 | 60.0 |
| | | Los Suris, 1981 | 13,577 | ... | 1 | ... | ... | 50.0 |
| | | La Vertiente, 1977 | 15,230 | 6 | 7 | 1,118 | 4,804,834 | 64.1 |
| | | Taiguati, 1981 | 10,174 | 1 | 2 | 193 | 70,409 | 63.0 |
| | | **Total Bolivia** | | 296 | 386 | 19,931 | 307,441,478 | |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **BRAZIL** | **ALAGOAS** | Furado, 1969 | 4,440- 5,500 | 51 | 68 | 2,030 | 15,400,380 | 35.0 |
| | | ● Mero, 1974 | 6,500- 7,400 | ... | ... | ... | 151,000 | 35.0 |
| | | Pilar, 1981 | 4,100- 5,100 | 56 | 62 | 5,580 | 14,089,900 | 40.0 |
| | | Tabuleiro de Martins, 1957 | 3,900- 4,950 | 28 | 29 | 430 | 4,154,450 | 27.0 |
| | | Other | ... | 18 | 27 | 560 | 2,169,520 | ... |
| | **AMAZONAS** | Igarape Cuia, 1985 | 3,600- 3,700 | ... | ... | ... | 25,250 | 41.0 |
| | | Rio Urucú, 1986 | 7,500- 8,300 | 13 | 13 | 3,200 | 1,254,000 | 44.0 |
| | **BAHIA** | Agua Grande, 1951 | 820- 4,265 | 113 | 124 | 4,830 | 276,968,000 | 40.0 |
| | | Aracas, 1965 | 3,280- 8,856 | 149 | 181 | 6,370 | 113,834,390 | 41.0 |
| | | Buracica, 1959 | 1,476- 1,840 | 171 | 190 | 5,600 | 139,922,730 | 35.0 |
| | | Candeias, 1941 | 3,280- 7,415 | 36 | 39 | 2,500 | 79,250,420 | 30.0 |
| | | ● Candeias Mar, 1941 | 3,300- 7,400 | 17 | 17 | 520 | 7,276,920 | 30.0 |
| | | Cassarongongo, 1959 | 1,475- 4,755 | 153 | 159 | 3,410 | 16,757,050 | 32.0 |
| | | Cexis, 1983 | 1,670- 5,230 | 34 | 34 | 2,690 | 4,771,900 | 30.0 |
| | | ● Dom Joao Mar, 1947 | 920- 3,000 | 219 | 289 | 3,450 | 83,792,880 | 38.0 |
| | | Dom Joao Terra, 1947 | 920- 1,350 | 57 | 94 | 890 | 21,002,610 | 38.0 |
| | | Faz. Alvorada, 1983 | 2,100- 4,900 | 80 | 80 | 4,850 | 8,403,730 | 31.0 |
| | | Faz. Balsamo, 1983 | 2,500- 4,000 | 114 | 118 | 6,600 | 11,342,630 | 31.0 |
| | | Faz. Boa Esperanca, 1966 | 7,215- 8,036 | 21 | 23 | 1,100 | 15,900,040 | 39.0 |
| | | Faz. Imbe, 1964 | 2,130- 5,575 | 59 | 78 | 1,800 | 16,044,860 | 40.0 |
| | | Faz. Panelas, 1962 | 2,400- 5,100 | 14 | 27 | 400 | 6,695,900 | 37.0 |
| | | ● Ilheus, 1979 | 1,500 | ... | ... | ... | 895,470 | 41.0 |
| | | Malombe, 1966 | 3,280 | 9 | 15 | 300 | 7,078,300 | 41.0 |
| | | Mata/Remanso, 1971 | 4,445- 4,560 | 63 | 76 | 1,830 | 20,897,720 | 35.0 |
| | | Miranga, 1965 | 3,280- 3,936 | 227 | 322 | 8,570 | 185,196,800 | 40.0 |
| | | Riacho da Barra, 1982 | 2,910- 3,998 | 51 | 63 | 2,900 | 12,691,340 | 39.0 |
| | | Rio Dos Ovos, 1979 | 2,410- 3,750 | 10 | 10 | 310 | 2,134,110 | 35.0 |
| | | Rio Pojuca, 1982 | 5,600- 6,200 | 29 | 42 | 2,200 | 5,340,500 | 35.0 |
| | | Rio do Bú, 1984 | 2,900- 3,000 | 50 | 50 | 3,950 | 4,219,650 | 33.0 |
| | | Santana, 1962 | 2,400- 4,000 | 5 | 6 | 100 | 5,640,870 | 7.0 |
| | | Sesmaria, 1963 | 3,100- 4,600 | 26 | 26 | 640 | 3,332,070 | 0.0 |
| | | Taquipe, 1958 | 3,115- 3,935 | 109 | 138 | 3,750 | 87,104,890 | 0.0 |
| | | Other | ... | 150 | 239 | 6,040 | 32,273,600 | ... |
| | **CEARÁ** | ● Atum, 1983 | 5,800- 6,750 | 20 | 22 | 5,420 | 9,926,100 | 25.0 |
| | | ● Curima, 1978 | 6,888 | 15 | 17 | 3,230 | 19,976,850 | 32.0 |
| | | ● Espada, 1983 | 5,750- 6,900 | 6 | 6 | 1,390 | 4,473,300 | 26.0 |
| | | Faz. Belem, 1980 | 1,150- 2,500 | 281 | 567 | 400 | 6,909,300 | 13.0 |
| | | ● Xareu, 1977 | 5,717- 5,766 | 25 | 27 | 2,700 | 15,501,100 | 39.0 |
| | **ESPIRITO SANTO** | ● Cacao, 1978 | 9,184 | 7 | 12 | 3,450 | 10,993,870 | 32.0 |
| | | Faz. Cedro, 1962 | 5,248 | 11 | 14 | 560 | 10,203,790 | 28.0 |
| | | Lagoa Parda, 1977 | 5,576 | 49 | 50 | 3,440 | 23,071,160 | 30.0 |
| | | Lagoa Piabanha, 1984 | 6,500 | 2 | 2 | 100 | 1,691,290 | 27.0 |
| | | Lagoa Suruaca, 1982 | 6,400 | 22 | 26 | 1,650 | 5,722,440 | 30.0 |
| | | Rio Itaunas, 1977 | 40 | 40 | 960 | 4,010,260 | 28.0 | |
| | | Rio Preto/Oeste/Sul, 1976 | ... | 37 | 37 | 730 | 2,361,870 | ... |
| | | Sao Mateus, 1969 | 5,750 | 45 | 53 | 1,060 | 4,920,730 | 27.0 |
| | | Other | ... | 125 | 125 | 4,880 | 8,250,830 | ... |
| | **RIO DE JANEIRO** | ● Albacora, 1984 | 8,430 | 7 | 12 | 16,930 | 12,985,230 | 26.0 |
| | | ● Anequim, 1981 | 8,200- 8,500 | 2 | 2 | 2,620 | 4,807,580 | 27.0 |
| | | ● Area RJS-150, 1983 | 7,300 | ... | ... | ... | 296,070 | 26.0 |
| | | ● Area RJS-236 Trilha, 1983 | 8,800-11,000 | 3 | 3 | 3,370 | 11,577,950 | 28.0 |
| | | ● Area RJS-387, 1987 | 11,300 | 3 | 3 | 2,030 | 2,818,080 | 34.0 |
| | | ● Badejo, 1981 | 8,500-10,500 | 5 | 6 | 3,390 | 18,675,900 | 28.0 |
| | | ● Bagre, 1983 | 8,700- 9,000 | 7 | 9 | 4,370 | 8,175,800 | 25.0 |
| | | ● Bicudo, 1982 | 8,000-11,000 | 11 | 13 | 17,970 | 42,172,120 | 22.0 |
| | | ● Bonito, 1977 | 6,950- 8,000 | 11 | 17 | 12,590 | 36,420,970 | 27.0 |
| | | ● Carapeba, 1982 | 10,100 | 29 | 36 | 16,570 | 6,062,050 | 23.0 |
| | | ● Cherne, 1982 | 9,900-10,200 | 29 | 41 | 37,490 | 66,063,850 | 27.0 |
| | | ● Corvina, 1983 | 9,000-11,000 | 5 | 8 | 15,040 | 36,197,360 | 25.0 |
| | | ● Enchova, 1976 | 6,973- 7,885 | 4 | 24 | 5,400 | 79,311,850 | 23.0 |
| | | ● Garoupa, 1974 | 11,382 | 19 | 20 | 21,290 | 77,847,590 | 30.0 |
| | | ● Garoupinha, 1974 | 12,693 | 3 | 3 | 2,960 | 12,880,240 | 30.0 |
| | | ● Linguado, 1981 | 9,000-11,000 | 11 | 18 | 25,760 | 73,211,580 | 20.0 |
| | | ● Marimba, 1983 | 8,900- 9,200 | 5 | 5 | 19,530 | 19,986,100 | 28.0 |
| | | ● Moreia, 1984 | 8,200- 9,500 | 5 | 6 | 3,400 | 4,616,400 | 22.0 |
| | | ● Namorado, 1975 | 10,083 | 27 | 45 | 55,320 | 140,641,710 | 28.0 |
| | | ● Pampo, 1977 | 6,215 | 24 | 31 | 36,200 | 122,714,750 | 21.0 |
| | | ● Parati, 1982 | 8,900- 9,200 | 1 | 1 | 1,120 | 5,566,630 | 35.0 |
| | | ● Pargo, 1975 | 11,840 | 16 | 21 | 12,350 | 4,509,410 | 20.0 |
| | | ● Pirauna, 1982 | 8,000-10,500 | 7 | 8 | 15,740 | 32,516,320 | 27.0 |
| | | ● Sul de Pampo, 1978 | 9,300- 9,600 | ... | ... | ... | ... | 20.0 |
| | | ● Vermelho, 1983 | 11,200 | 45 | 62 | 12,550 | 4,579,600 | 24.0 |
| | | ● Viola, 1981 | 9,200- 9,900 | 8 | 8 | 7,310 | 13,898,640 | 13.0 |
| | **RIO GRANDE DO NORTE** | ● Agulha, 1975 | 5,412 | 5 | 6 | 1,000 | 7,761,100 | 33.0 |
| | | Alto do Rodrigues, 1981 | 990- 1,120 | 290 | 292 | 3,570 | 8,518,410 | 18.0 |
| | | ● Area 1-RNS-36, 1982 | ... | ... | ... | ... | 178,290 | 32.0 |
| | | Canto do Amaro, 1986 | 2,500- 3,600 | 470 | 486 | 34,200 | 22,143,060 | 25.0 |
| | | Estreito/Rio Panon, 1983 | 650- 820 | 447 | 447 | 5,400 | 12,190,780 | 16.0 |
| | | Faz. Pocinho, 1982 | 1,450- 2,000 | 174 | 174 | 4,420 | 11,818,520 | 35.0 |
| | | Guamaré, 1983 | 1,400- 1,600 | 30 | 33 | 560 | 1,844,960 | 25.0 |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Livramento, 1986 | 2,500- 3,300 | 30 | 30 | 2,900 | 4,856,670 | 41.0 |
| | | Lorena, 1984 | 1,200- 1,700 | 12 | 12 | 240 | 836,420 | 28.0 |
| | | • Macau-Mar, 1986 | 3,000 | 5 | 5 | 170 | 508,370 | 31.0 |
| | | Macau/Terra, 1982 | 3,000- 3,300 | 2 | 2 | 50 | 449,040 | 31.0 |
| | | Palmeiras, 1982 | 1,450- 1,800 | ... | ... | ... | ... | 25.0 |
| | | Serraria, 1982 | 3,200- 3,900 | 38 | 38 | 1,320 | 3,374,340 | 27.0 |
| | | • Ubarana, 1973 | 7,216- 8,365 | 77 | 92 | 14,650 | 58,134,730 | 40.0 |
| | | Upanema, 1985 | 1,110- 1,800 | 15 | 18 | 850 | 2,239,380 | 28.0 |
| | | Other | ... | 118 | 119 | 4,850 | 4,220,020 | ... |
| | **PARÁ** | • Area 1-PAS-11, 1983 | ... | ... | ... | ... | 421,300 | 41.0 |
| | **MARANHÃO** | São João, 1983 | 4,950- 6,200 | ... | ... | ... | 75,000 | 40.0 |
| | **SERGIPE** | Atalaia Sul, 1961 | 1,450 | 2 | 3 | 7 | 2,688,650 | 24.0 |
| | | Brejo Grande, 1967 | 1,670 | 12 | 12 | 300 | 2,009,740 | 26.0 |
| | | • Caioba, 1969 | 6,232- 6,890 | 10 | 14 | 1,770 | 30,996,420 | 36.0 |
| | | • Camurim, 1970 | 6,232 | 61 | 62 | 6,490 | 19,754,830 | 25.0 |
| | | Carmopolis, 1963 | 2,460 | 852 | 1,008 | 25,970 | 179,890,490 | 24.0 |
| | | • Dourado, 1970 | 3,620- 3,635 | 4 | 4 | 270 | 4,546,540 | 36.0 |
| | | • Guaricema, 1968 | 3,335- 4,430 | 13 | 16 | 4,040 | 37,959,950 | 41.0 |
| | | Riachuelo, 1961 | 1,475 | 235 | 318 | 3,400 | 23,090,630 | 28.0 |
| | | • Robalo, 1973 | 3,300- 4,500 | ... | ... | ... | 828,000 | 30.0 |
| | | Siririzinho, 1967 | 1,640 | 177 | 260 | 4,730 | 38,023,300 | 30.0 |
| | | Other | ... | 84 | 85 | 1,420 | 4,735,450 | ... |
| | | **Total Brazil** | | **6,267** | **7,574** | **591,697** | **2,656,654,940** | |
| **BRUNEI** | **SHELL** | • Ampa SW, 1963 | 7,068- 8,155 | 116 | 222 | 41,640 | 543,800,000 | 41.0 |
| | | • Champion, 1970 | 4,300 | 113 | 213 | 41,067 | 315,100,000 | 23.0 |
| | | • Fairley, 1969 | 10,740 | 37 | 54 | 13,907 | 115,300,000 | 40.0 |
| | | • Magpie, 1975 | ... | 17 | 23 | 16,033 | 79,300,000 | 31.0 |
| | | Rasau, 1929 | ... | 4 | 13 | 786 | 5,300,000 | 30.0 |
| | | Seria-Total, 1929 | ... | 269 | 569 | 18,977 | 988,200,000 | 34.0 |
| | | **Total Brunei** | | **556** | **1,094** | **132,410** | **2,047,000** | |
| **CAMEROON(e)** | **ELF** | • Betika, 1972 | 5,300 | 175 | 179 | 169,000 | 501,504,900 | 42.5 |
| | | • Ekoundou S., 1975 | 6,200 | | | | | 24.0 |
| | | • Kole, 1974 | 5,500 | | | | | 31.0 |
| | | • Kombo Center, 1976 | 5,900 | | | | | 37.0 |
| | | • Kombo North, 1978 | 7,200 | | | | | 35.0 |
| | | • Ekoundou Horst plus Center, 1972 | 7,200 | | | | | 29.0 |
| | | • Boa, 1976 | 5,900 | | | | | 35.0 |
| | | • Bavo South, 1976 | 5,600 | | | | | 29.3 |
| | | • Betika S. Marine, 1979 | 6,300 | | | | | 30.0 |
| | | • Ekuondou N. Marine, 1977 | 5,250 | | | | | 36.0 |
| | | • Mokoko NE plus Abana, 1977 | 4,600 | | | | | 29.0 |
| | | • Asoma Marine, 1973 | 3,600 | | | | | 19.0 |
| | | • Kita E. Marine, 1978 | 6,900 | | | | | 40.8 |
| | | • Mokoko S. Marine, 1977 | 3,300 | | | | | 17.0 |
| | | • Inova Marine, 1976 | 6,200 | | | | | 32.8 |
| | **TOTAL-CFP** | • Moudi, 1979 | 5,250- 5,900 | | | | | 40.0 |
| | | • Moudi D., 1980 | 3,300 | | | | | 21.3 |
| | | **Total Cameroon** | | **175** | **179** | **169,000** | **501,504,900** | |
| **CANADA** | **ALBERTA** | Acheson, 1950 | 3,390 | 57 | 118 | 13,180 | 132,037,229 | 38.0 |
| | | Bantry, 1940 | 2,574- 3,300 | 171 | 210 | 9,270 | 52,741,483 | ... |
| | | Bellshill Lake, 1955 | 2,950 | 425 | 458 | 11,640 | 67,493,984 | ... |
| | | Bonnie Glen, 1952 | 3,959- 6,779 | 134 | 169 | 12,445 | 507,143,641 | 34.0-44.0 |
| | | Caroline | ... | 187 | 282 | 7,800 | 68,884,903 | ... |
| | | Carson Creek N., 1958 | 8,787- 8,935 | 36 | 64 | 7,935 | 143,308,313 | 44.0 |
| | | Clive, 1951 | 6,074- 6,208 | 117 | 186 | 4,771 | 52,946,209 | ... |
| | | Cessford, 1950 | 2,800- 3,028 | 173 | 301 | 2,867 | 32,012,372 | ... |
| | | Countess, 1951 | 2,858- 4,272 | 134 | 173 | 6,019 | 66,053,533 | ... |
| | | Fenn-Big Valley, 1950 | 3,900- 5,400 | 118 | 295 | 5,323 | 317,705,752 | 32.0 |
| | | Gilby, 1962 | 4,201- 7,000 | 71 | 162 | 2,899 | 48,510,868 | ... |
| | | Golden Spike, 1949 | 3,570- 5,961 | 69 | 84 | 2,025 | 182,483,299 | 36.0 |
| | | Grand Forks | ... | 363 | 453 | 21,745 | 98,317,645 | ... |
| | | Harmattan East, 1954 | 6,358- 8,766 | 106 | 147 | 4,409 | 74,137,864 | ... |
| | | Harmatton Elkton, 1955 | 8,796-10,757 | 63 | 82 | 3,919 | 63,493,732 | ... |
| | | Hayter, 1968 | 2,030- 2,815 | 258 | 418 | 7,236 | 15,372,066 | ... |
| | | Innisfail, 1956 | 6,730- 8,440 | 27 | 70 | 4,073 | 76,682,493 | ... |
| | | Joarcam, 1949 | 3,179 | 173 | 272 | 6,097 | 104,473,973 | ... |
| | | Joffre, 1953 | 4,983- 6,779 | 83 | 187 | 3,784 | 84,639,872 | ... |
| | | Judy Creek, 1951 | 8,307- 8,701 | 183 | 268 | 19,349 | 402,547,694 | 43.0 |
| | | Kaybob, 1957 | 4,870- 9,577 | 68 | 94 | 5,869 | 104,674,986 | ... |
| | | Kaybob S., 1958 | 5,600-10,042 | 72 | 100 | 7,736 | 82,373,557 | ... |
| | | Leduc-Woodbend, 1947 | 3,062- 5,380 | 236 | 708 | 3,586 | 378,143,547 | 40.0 |
| | | Lloydminster, 1933 | 1,690- 1,945 | 413 | 964 | 5,066 | 51,224,674 | ... |
| | | Medicine River, 1954 | 5,435- 7,600 | 259 | 364 | 10,175 | 75,086,351 | ... |
| | | Mitsue, 1964 | 5,908 | 293 | 411 | 31,881 | 293,845,831 | 43.0 |
| | | Nipisi, 1965 | 5,648- 5,726 | 270 | 359 | 29,124 | 285,619,187 | 41.0 |

| | Name of field, discovery date | Depth, ft | No. of wells Producing | No. of wells Total | Production 1989 average B/d | Production Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|---|---|---|---|---|---|---|---|
| | Pembina, 1953 | 3,000- 6,133 | 3,340 | 4,245 | 98,870 | 1,277,689,925 | 32.0-37.0 |
| | Provost, 1946 | 2,760- 2,898 | 1,561 | 2,104 | 40,139 | 94,882,223 | ... |
| | Rainbow, 1965 | 4,994- 6,160 | 268 | 367 | 41,715 | 529,321,452 | 38.0-42.0 |
| | Rainbow South, 1965 | 6,102- 6,400 | 47 | 80 | 5,954 | 66,441,552 | ... |
| | Red Earth, 1956 | 4,184- 4,878 | 186 | 280 | 4,838 | 39,730,041 | ... |
| | Redwater, 1948 | 2,012- 3,200 | 588 | 884 | 12,957 | 794,082,745 | 35.0 |
| | Simonette, 1958 | 10,500 | 28 | 51 | 2,114 | 38,982,776 | ... |
| | Snipe Lake, 1962 | 8,500 | 39 | 97 | 3,392 | 55,287,679 | ... |
| | Sturgeon Lake S., 1953 | 4,912- 8,471 | 89 | 149 | 13,976 | 147,941,250 | ... |
| | Swan Hills, 1957 | 8,100 | 566 | 837 | 37,683 | 695,276,591 | 40.0 |
| | Swan Hills S., 1959 | 8,400 | 169 | 200 | 14,100 | 349,577,767 | ... |
| | Taber N., 1966 | 3,110- 3,270 | 78 | 106 | 5,845 | 16,973,413 | ... |
| | Turner Valley, 1913 | 3,100- 9,150 | 111 | 158 | 2,612 | 140,871,493 | 39.0 |
| | Utikuma Lake, 1963 | 5,624 | 109 | 139 | 11,742 | 52,240,255 | ... |
| | Valhalla, 1973 | 1,815- 7,060 | 258 | 303 | 8,056 | 13,720,829 | ... |
| | Virginia Hills, 1957 | 9,210 | 127 | 188 | 15,927 | 153,776,591 | 34.0 |
| | Wainwright, 1925 | 1,903- 2,200 | 565 | 756 | 8,947 | 72,358,599 | ... |
| | Westerose, 1952 | 6,818 | 34 | 42 | 10,009 | 134,043,358 | ... |
| | Westpem | ... | 11 | 14 | 13,356 | 30,693,959 | ... |
| | Willisden Green, 1956 | 5,157 | 563 | 823 | 8,026 | 120,111,497 | ... |
| | Wizard Lake, 1951 | 4,044- 5,973 | 42 | 47 | 9,142 | 325,853,244 | ... |
| | Zama, 1966 | 3,702 | 120 | 243 | 6,719 | 78,026,436 | 33.0-37.0 |
| | Other | ... | 8,362 | 13,061 | 312,623 | 1,594,878,246 | ... |
| **BRITISH COLUMBIA** | Boundary Lake, 1957 | 3,418- 4,575 | 279 | 358 | 9,775 | 175,250,142 | 40.0 |
| | Eagle West, 1976 | 2,170- 3,940 | 51 | 96 | 6,224 | 29,198,918 | ... |
| | Other | ... | 375 | 813 | 18,103 | 240,343,836 | ... |
| **MANITOBA** | All fields | ... | 1,353 | 1,581 | 12,462 | 170,671,122 | ... |
| **SASKATCHEWAN** | Steelman, 1950 | ... | 646 | 731 | 8,499 | 258,451,734 | ... |
| | Weyburn, 1955 | 4,600 | 821 | 895 | 16,692 | 293,279,794 | ... |
| | Other | ... | 12,199 | 16,939 | 175,397 | 1,778,953,854 | ... |
| **ONTARIO** | All fields | ... | 1,091 | 1,588 | 4,202 | 63,782,474 | ... |
| **NEW BRUNSWICK** | All fields | ... | ... | ... | ... | 805,261 | ... |
| **NORTHWEST TERRITORIES** | All fields | ... | 159 | 164 | 32,344 | 77,377,132 | ... |
| *Does not include oil sands production nor wells. | **Total Canada*** | | **38,794** | **55,738** | **1,222,673** | **13,772,831,606** | |
| **CHILE** **ENAP-MAINLAND** | Canadon, 1962 | 6,090 | 11 | 62 | 189 | 14,627,376 | 38.4 |
| | Daniel, 1960 | 5,806 | 10 | 121 | 195 | 34,553,574 | 25.4 |
| | Daniel Este, 1961 | 5,523 | 9 | 66 | 227 | 28,500,354 | 25.0 |
| | Delgada Este, 1958 | 7,694 | 9 | 31 | 195 | 4,935,059 | 35.0 |
| | Dungeness, 1962 | 5,251 | 4 | 19 | 198 | 4,060,927 | 28.6 |
| | Faro Este, 1959 | 7,381 | 7 | 32 | 192 | 3,362,757 | 35.0 |
| | Posesion, 1960 | 5,622 | 31 | 76 | 675 | 21,685,069 | 63.6 |
| | Other | ... | 9 | 118 | 1,964 | 15,605,639 | ... |
| **TIERRA DEL FUEGO** | Calafate, 1955 | 6,045 | 17 | 61 | 839 | 26,121,984 | 49.3 |
| | Catalina, 1956 | 5,756 | 9 | 26 | 351 | 6,615,322 | 38.7 |
| | Catalina Sur, 1961 | 5,779 | 4 | 43 | 45 | 6,385,022 | 44.0 |
| | Chañarcillo, 1951 | 7,404 | 2 | 17 | 44 | 7,241,717 | 58.2 |
| | Cullen, 1954 | 5,730 | 17 | 106 | 341 | 41,233,096 | 41.8 |
| | Gorrión, 1986 | 6,025 | 6 | 10 | 756 | 1,017,551 | 39.0 |
| | San Sebastián Norte, 1986 | 6,870 | 4 | 4 | 85 | 168,471 | 37.0 |
| | Sombrero, 1951 | 7,126 | 1 | 23 | 3 | 13,108,843 | 40.2 |
| | Tres Lagos, 1957 | 5,724 | 22 | 84 | 507 | 16,148,103 | 40.1 |
| | Victoria Sur, 1950 | 7,431 | 4 | 34 | 52 | 7,876,783 | 41.1 |
| | Other | ... | 46 | 255 | 1,272 | 30,664,301 | ... |
| **STRAIT OF MAGELLAN** | Daniel Este-Dungeness, 1977 | 6,126 | 14 | 36 | 1,432 | 4,685,424 | 35.9 |
| | Jaiba, 1978 | 6,650 | 3 | 3 | 188 | 314,213 | 46.5 |
| | Ostion, 1977 | 7,156 | 13 | 18 | 644 | 8,314,321 | 33.0 |
| | Pejerrey, 1984 | 7,229 | 20 | 75 | 1,384 | 9,959,809 | 39.0 |
| | Posesion, 1977 | 6,727 | 17 | 39 | 493 | 5,555,950 | 34.5 |
| | Skúa, 1988 | 5,932 | 34 | 39 | 4,903 | 2,965,391 | 32.0 |
| | Spiteful, 1977 | 6,298 | 34 | 82 | 2,993 | 43,534,087 | 34.5 |
| | Spiteful Norte, 1978 | 7,150 | 9 | 55 | 455 | 9,661,180 | 39.0 |
| | **Total Chile** | | **366** | **1,535** | **20,613** | **368,917,323** | |
| **CHINA(e)** **WESTERN REGION: JUNGGAR BASIN, TARIM BASIN, TURPEN BASIN** | Karamay, 1955 | ... | | | | | ... |
| | Dushanzi, 1941 | ... | | | | | ... |
| | Other | ... | | | | | ... |
| **CENTRAL REGION: JIUQUAN BASIN** | Yumen, 1938 | ... | | | | | ... |
| **CENTRAL REGION: SICHUAN BASIN** | All fields | ... | | | | | ... |
| **CENTRAL REGION: SHAN-GAN-NING BASIN** | Chang Qing, 1978 | ... | | | | | ... |
| | Yanchang, 1907 | ... | | | | | ... |
| **CENTRAL REGION: QAIDAM BASIN** | Qinghai, 1955 | ... | | | | | ... |
| | Lenghu 3,4,5, 1958 | ... | | | | | ... |
| | Other | ... | | | | | ... |

| | | Name of field, discovery date | Depth, ft | No. of wells Producing | No. of wells Total | Production 1989 average B/d | Production Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|---|---|---|---|---|---|---|---|---|
| | **EASTERN REGION: SONGLIAO BASIN** | Daqing, 1959 | ... | 43,700 | NA | 2,747,507 | 14,699,906,000 | ... |
| | | Fuyn, 1958 | ... | | | | | ... |
| | | Jilin, 1978 | ... | | | | | ... |
| | **EASTERN REGION: BOHAI BASIN** | Shengli, 1962 | ... | | | | | ... |
| | | Renqiu, 1975 | ... | | | | | ... |
| | | Liaohe, 1964 | ... | | | | | ... |
| | | Dagang, 1964 | ... | | | | | ... |
| | | Zhongyuan, 1981 | ... | | | | | ... |
| | | Itu, 1970 | ... | | | | | ... |
| | **EASTERN REGION: JIANGHAN BASIN** | Qianjiang, 1966 | ... | | | | | ... |
| | | Other | ... | | | | | ... |
| | **EASTERN REGION: NANXIANG BASIN** | Nanyang, 1971 | ... | | | | | ... |
| | **EASTERN REGION: SUBEI BASIN** | All fields | ... | | | | | ... |
| | | **Total China** | | **43,700** | **NA** | **2,747,507** | **14,699,906,000** | |
| **CHINA, TAIWAN** | **CHINESE PETROLEUM** | • CBK, 1986 | ... | 5 | 9 | 757 | 23,565,169 | 47.0 |
| | | Chingtsohu, 1967 | ... | 5 | 17 | 82 | | 50.0 |
| | | Chuhuangkeng, 1960 | ... | 30 | 30 | 232 | | 50.0 |
| | | Tiechengshan, 1959 | ... | 23 | 31 | 931 | | 51.0 |
| | | Yunghoshan, 1971 | ... | 25 | 33 | 314 | | 45.0 |
| | | **Total China, Taiwan** | | **88** | **120** | **2,326** | **23,565,169** | |
| **COLOMBIA** | **ARGOSY(e)** | Bourdine, 1974 | 11,000 | 2 | 4 | 54,888 | 302,478,624 | 26.7 |
| | | Máxime, 1976 | 11,000 | 1 | 1 | | | 11.0 |
| | | Nancy, 1974 | 11,000 | 1 | 1 | | | 26.0 |
| | **HOCOL SA (SHELL)(e)** | Palogrande, 1971 | 6,500 | 32 | 36 | | | 20.0 |
| | | Pijao, 1981 | 7,000 | 6 | 7 | | | 21.0 |
| | | San Francisco, 1985 | 2,800 | 41 | 41 | | | 27.0 |
| | | Hato Nuevo, 1984 | 6,900 | 2 | 4 | | | 36.0 |
| | | Tenay, 1985 | 11,500 | 3 | 3 | | | 36.3 |
| | | Santa Clara, 1987 | 2,100 | 5 | 6 | | | 19.0 |
| | | La Jagua, 1986 | 5,300 | 2 | 2 | | | 22.0 |
| | | Loma Larga, 1985 | 3,500 | 1 | 1 | | | 22.4 |
| | | Brisas, 1973 | 4,200 | 4 | 6 | | | 23.5 |
| | | Dina T, 1962 | 3,600 | 51 | 64 | | | 20.0 |
| | | Dina K, 1969 | 6,500 | 22 | 26 | | | 22.0 |
| | | La Canada, 1966 | 700 | 5 | 7 | | | 22.0 |
| | | Tello, 1972 | 7,500 | 30 | 34 | | | 22.0 |
| | | Cebu, 1981 | 6,500 | 8 | 10 | | | 19.0 |
| | **ECOPETROL** | Apiay, 1981 | 10,600 | 13 | 15 | 12,370 | 20,350,000 | 23.0 |
| | | Apiay Este, 1987 | 10,300 | 1 | 1 | 190 | 150,000 | 16.0 |
| | | Boquete, 1962 | 8,100 | 8 | 24 | 330 | 17,500,000 | 43.0 |
| | | Caipal/Ermitaño, 1954, 1957 | 3,500 | 3 | 19 | 60 | 4,280,000 | 15.0 |
| | | Campo Yuca, 1958 | ... | 1 | 4 | 10 | 450,000 | 32.0 |
| | | Cantagallo/Yarigui, 1943, 1955 | 6,800-8,700 | 68 | 92 | 7,300 | 135,040,000 | 20.0 |
| | | Carbonera, 1939 | ... | 4 | 8 | 40 | 490,000 | 32.0 |
| | | Caribe, 1970 | 5,400 | 3 | 4 | 320 | 3,860,000 | 31.0 |
| | | Casabe, 1940 | 3,800 | 909 | 1,039 | 9,700 | 231,750,000 | 19.0-22.0 |
| | | Churuyaco/Sucombios, 1967, 1969 | ... | 6 | 7 | 510 | 4,750,000 | 31.0 |
| | | Cicuco, 1948 | 8,600 | 5 | 28 | 300 | 43,610,000 | 41.0 |
| | | Colorado, 1925 | ... | 45 | 76 | 80 | 8,190,000 | 34.0 |
| | | Galan/San Silvestre, 1943 | 3,200 | 53 | 102 | 820 | 23,310,000 | 18.0 |
| | | Garzas, 1957 | ... | 1 | 2 | 110 | 570,000 | 28.0 |
| | | Guatiquia, 1985 | 10,700 | 2 | 2 | 620 | 360,000 | 20.0 |
| | | Hormiga, 1982 | 10,300 | 2 | 3 | 160 | 710,000 | 29.0 |
| | | Infantas, 1918 | 3,200 | 305 | 568 | 1,750 | 226,070,000 | 28.0 |
| | | La Cira, 1918 | 3,250 | 707 | 951 | 7,610 | 468,670,000 | 23.0 |
| | | La Cristalina, 1950 | 10,000 | 1 | 8 | 200 | 5,690,000 | 30.0 |
| | | Llanito/Gala/Yuma/Cardales, 1955, 1985, 1988, 1988 | 9,500 | 145 | 219 | 6,480 | 41,970,000 | 28.0-32.0 |
| | | Lisama/Nutria/Tesoro Petroles, 1936, 1966, 1977 | 9,500 | 145 | 219 | 6,480 | 41,970,000 | 28.0-32.0 |
| | | Loro, 19067 | 10,300 | 7 | 12 | 710 | 11,570,000 | 30.0 |
| | | Orito, 1948 | 600- 5,200 | 51 | 104 | 8,790 | 196,310,000 | 25.0-35.0 |
| | | Ortega, 1951 | 6,500 | 5 | 15 | 380 | 11;750,000 | 28.0 |
| | | Palagua, 1954 | 3,500 | 96 | 186 | 3,840 | 83,330,000 | 15.0 |
| | | Peñas Blancas, 1957 | ... | 6 | 7 | 380 | 8,910,000 | 23.0 |
| | | Petrolea, 1933 | 1,200 | 5 | 34 | 150 | 36,970,000 | 46.0 |
| | | Puerto Barco, 1958 | ... | ... | 4 | 20 | 600,000 | 50.0-60.0 |
| | | Puerto Colon, 1967 | 9,600 | 7 | 10 | 4,030 | 13,730,000 | 29.0 |
| | | Quilili, 1988 | ... | 2 | 3 | 610 | 250,000 | 21.0 |
| | | Rio de Oro, 1933 | 1,600-8,500 | 20 | 54 | 60 | 10,670,000 | 32.0-43.0 |
| | | San Antonio (S. Miguel), 1967 | 7,820 | 2 | 4 | 80 | 4,740,000 | 28.0 |
| | | Sardinata Norte/Sur, 1939, 1942 | 900- 4,100 | 14 | 39 | 260 | 8,480,000 | 30.0-52.0 |
| | | Sucio, 1971 | 5,500 | 1 | 2 | 70 | 1,480,000 | 31.0 |
| | | Suria, 1985 | 10,500 | 7 | 8 | 2,290 | 850,000 | 35.0 |
| | | Tibu, 1939 | 4,500- 9,300 | 250 | 508 | 4,980 | 230,310,000 | 32.0-45.0 |
| | | Toldado, 1987 | 6,200 | 6 | 7 | 2,680 | 1,050,000 | 20.0 |

| | | Name of field, discovery date | Depth, ft | No. of wells — Producing | No. of wells — Total | Production — 1989 average B/d | Production — Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|---|---|---|---|---|---|---|---|---|
| | | Other | ... | 7 | 71 | ... | 990,000 | ... |
| | | Aguas Blancas, 1962 | ... | 4 | 7 | 3,100 | 650,000 | 20.0 |
| | | Barrancas Lebrija, 1953 | 8,000 | 2 | 11 | | 140,000 | 25.0 |
| | | Pavas, 1981 | ... | 1 | 1 | | 40,000 | 21.0 |
| | | San Luis, Totomal, 1927, 1950 | ... | 2 | 7 | | 1,200,000 | 24.0-35.0 |
| | | Sogamoso, 1958 | ... | 2 | 4 | | 850,000 | 29.0 |
| | | Tenerife, 1967 | ... | 1 | 3 | | 390,000 | 18.0 |
| | **ESSO COLOMBIANA LTD.** | Arauca, 1980 | 18,000 | 3 | 4 | 1,775 | 5,913,510 | 40.0 |
| | | Bonanza, 1963 | 4,000 | 17 | 17 | 646 | 13,246,795 | 27.0 |
| | | Provincia, 1962 | 8,000 | 152 | 172 | 14,926 | 166,964,261 | 30.0 |
| | | Sabana, 1989 | 14,000 | 3 | 3 | 186 | 103,697 | 25.0 |
| | **ELF AQUITAINE** | Barquerena, 1982 | 9,300 | 3 | 3 | 1,408 | 3,327,205 | 33.5 |
| | | Cano Garza, 1979 | 7,900 | 4 | 4 | 2,281 | 2,123,708 | 33.0 |
| | | Cano Garza Norte, 1983 | 7,900 | 2 | 2 | 915 | 2,009,235 | 38.5 |
| | | Cravo Este, 1987 | 11,376 | ... | 1 | 289 | 108,833 | 40.1 |
| | | Cravo Sur, 1982 | 10,600 | 2 | 2 | 1,865 | 2,925,853 | 39.0 |
| | | Gloria Norte, 1983 | 12,100 | 2 | 2 | 2,031 | 1,605,104 | 18.0 |
| | | Morichal, 1984 | 15,500 | 1 | 1 | 273 | 99,542 | 30.0 |
| | | Tierra Blanca, 1987 | 14,493 | 1 | 1 | 358 | 130,506 | 32.0 |
| | | Tocaria, 1980 | 13,500 | 2 | 3 | 720 | 1,179,647 | 32.2 |
| | | Trinidad, 1974 | 9,000 | 4 | 4 | 3,788 | 5,090,719 | 33.0 |
| | **OCCIDENTAL** | Caño Limón, 1984 | 7,600 | 47 | 54 | 172,219 | 230,057,128 | 29.0 |
| | | Cano Yarumal, 1987 | 7,600 | 2 | 2 | 12,256 | 4,630,143 | 29.0 |
| | | La Salina, 1936 | 2,500 | 38 | 71 | 3,105 | 14,494,004 | 28.0 |
| | | Payoa, 1962 | 8,000 | 24 | 39 | 953 | 70,022,300 | 27.0 |
| | | Redondo, 1984 | 7,600 | 3 | 4 | 5,678 | 5,998,120 | 30.2 |
| | **TEXACO** | Cocorná, 19[illegible]3 | 2,100 | 46 | 54 | 1,726 | 14,539,000 | 2.0-13.0 |
| | | Tisquirama, 1963 | 8,000 | 5 | 6 | 422 | 4,977,000 | 6.0-28.0 |
| | | Velasquez, 1946 | 7,500 | 92 | 100 | 3,123 | 166,961,000 | 9.0-24.0 |
| | **TEXACO-ECOPETROL** | Los Angeles, 1983 | 6,400 | 4 | 6 | 669 | 784,000 | 4.0-15.0 |
| | | Nare, 1981 | 2,100 | 49 | 49 | 1,792 | 974,000 | 1.0-12.0 |
| | | Teca, 1981 | 2,100 | 187 | 200 | 14,241 | 29,976,000 | 2.0-13.0 |
| | **CHEVRON** | Castilla, 1969 | 6,500 | 17 | 19 | 12,528 | 29,430,090 | 13.5 |
| | | Chichimene, 1969 | 6,500 | 1 | 2 | 466 | 770,488 | 21.3 |
| | **LASMO** | Santiago, 1985 | 9,600 | 4 | 4 | 2,343 | 2,093,945 | 29.0 |
| | | **Total Colombia** | | **3,771** | **5,442** | **404,000** | **2,971,904,457** | |
| **CONGO** | **AGIP** | • Loango, 1972 | 3,000 | 52 | 62 | 7,823 | 87,479,524 | 6.8 |
| | | Zatchi | 1,980 | 8 | 8 | 3,296 | 1,486,665 | 5.9 |
| | **ELF CONGO** | Bindi, 1982 | 4,400 | 1 | 1 | 40 | 143,000 | 34.2 |
| | | • Emeraude, 1969 | 820 | 92 | 99 | 20,300 | 175,400,000 | 22.3 |
| | | Kunji, 1980 | 4,000 | 2 | 2 | 130 | 586,000 | 35.8 |
| | | • Likouala, 1972 | 4,270 | 27 | 44 | 15,300 | 62,800,000 | 32.3 |
| | | Mengo, 1979 | 6,500 | 3 | 3 | 150 | 742,000 | 34.0 |
| | | Pointe Indienne, 1951 | 5,000 | 3 | 5 | 130 | 7,108,000 | 36.9 |
| | | • Sendji, 1973 | 3,940 | 50 | 76 | 29,100 | 65,600,000 | 29.5 |
| | | • Tchibouela, 1983 | 2,110 | 26 | 29 | 46,000 | 26,500,000 | 27.0 |
| | | • Yanga, 1979 | 2,950 | 48 | 63 | 17,000 | 75,200,000 | 29.4 |
| | | **Total Congo** | | **312** | **392** | **139,269** | **503,045,189** | |
| **DENMARK** | **DUC** | • Dan, 1971 | 6,000- 6,400 | 41 | 49 | 25,386 | 57,274,190 | 29.5 |
| | | • Gorm, 1971 | 6,500- 7,000 | 20 | 26 | 23,263 | 84,058,230 | 33.9 |
| | | • Rolf, 1981 | 5,900 | 1 | 2 | 6,802 | 11,910,953 | 35.3 |
| | | • Skjold, 1977 | 5,000 | 3 | 7 | 38,174 | 49,052,790 | 30.3 |
| | | • Tyra, 1968 | 6,500 | 30 | 38 | 18,094 | 24,131,390 | 50.4 |
| | | **Total Denmark** | | **95** | **122** | **111,7[illegible]** | **226,427,553** | |
| **DUBAI** | **DUPETCO[(e)]** | • Fateh, 1966 | 7,900- 9,000 | 141 | 156 | 400,880 | 2,169,802,600 | 31.8 |
| | | • S.W. Fateh, 1970 | 7,500- 9,000 | | | | | 30.3 |
| | | • Falah, 1972 | 8,100 | | | | | 25.5 |
| | | • Rashid, 1973 | 9,400-11,500 | | | | | 38.0 |
| | **ARCO** | Margham, 1981 | 11,200 | 8 | 14 | 14,520 | 34,560,000 | 43.5 |
| | | **Total Dubai** | | **149** | **170** | **415,400** | **2,204,362,600** | |
| **ECUADOR** | **TEXACO-PETROECUADOR** | Atacapi, 1968 | 9,855 | 4 | 5 | 1,505 | 12,762,667 | 31.0 |
| | | Auca, 1970 | 10,578 | 23 | 24 | 15,701 | 76,770,667 | 28.0 |
| | | Auca Sur, 1980 | 9,100-10,300 | 2 | 2 | 614 | 1,634,667 | 25.6 |
| | | Cononaco, 1972 | 11,233 | 9 | 11 | 12,785 | 30,736,000 | 33.3 |
| | | Culebra, 1973 | 10,626 | 2 | 2 | 1,125 | 2,578,667 | 17.5 |
| | | Dureno/Guanta, 1968 | 9,575-10,290 | 10 | 10 | 7,883 | 8,613,333 | 31.0 |
| | | Lago Agrio, 1967 | 10,175 | 18 | 24 | 8,738 | 126,482,667 | 28.5 |
| | | Parahuacu, 1968 | 10,173 | 3 | 5 | 1,607 | 7,578,667 | 30.0 |
| | | Rumiyacu, 1982 | 10,191 | ... | 1 | ... | 184,000 | 21.0 |
| | | Sacha, 1969 | 10,160 | 96 | 103 | 63,613 | 406,144,000 | 28.0 |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Shushufindi/Aguarico, 1959 | 9,772 | 52 | 60 | 100,953 | 630,930,667 | 30.0 |
| | | Yuca, 1970 | 10,423 | 6 | 7 | 2,681 | 12,352,000 | 28.0 |
| | | Yuca Sur, 1979 | 9,600-10,000 | 1 | 1 | 351 | 1,242,667 | 14.5 |
| | | Yulebra, 1980 | 8,800-10,000 | 3 | 3 | 1,753 | 3,589,333 | 21.4 |
| | **CICL** | Fanny, 1972 | 7,700 | 8 | 8 | 4,685 | 12,900,120 | 22.5 |
| | | Mariann, 1971 | 7,700 | 5 | 5 | 1,048 | 4,302,360 | 20.0 |
| | | Tarapoa, 1973 | 8,300 | 1 | 2 | 333 | 1,150,807 | 20.0 |
| | **CEPE-ORIENT** | Bermejo Sur + Norte, 1967 | 5,000 | 21 | 26 | 5,475 | 7,572,353 | 32.5 |
| | | Charapa, 1967 | 10,000 | 1 | 4 | 291 | 754,353 | 29.5 |
| | | Cuyabeno, 1972 | 8,050 | 15 | 19 | 7,872 | 15,752,162 | 27.4 |
| | | Libertador | ... | 44 | 50 | 37,306 | 77,644,900 | 29.7 |
| | | Tetete-Tapi, 1980 | 9,300 | 6 | 11 | 2,738 | 5,961,647 | 29.1 |
| | **CEPE-PENINSULA** | Ancon, 1921 | 4,000 | 439 | 439 | 652 | 111,600,000 | 35.7 |
| | | Carpet | ... | 99 | 99 | 124 | | 36.4 |
| | | Cautivo | ... | 79 | 79 | 112 | | 36.4 |
| | | **Total Ecuador** | | 947 | 1,000 | 279,945 | 1,559,239,324 | |
| **EGYPT** | **GUPCO/AMOCO** | Abu Gharadig, 1972 | 9,300-12,000 | 17 | 27 | 11,005 | 58,691,385 | 35.0-55.0 |
| | | • Badri (315), 1981 | 6,400 | 22 | 38 | 28,935 | 67,516,833 | 27.0 |
| | | • El Morgan, 1965 | 5,000- 7,500 | 109 | 126 | 95,142 | 1,063,276,893 | 27.0-32.0 |
| | | • GH (376), 1981 | 8,200- 9,750 | 1 | 5 | 291 | 6,153,319 | 24.0-28.0 |
| | | • GS (277) 1980 | 8,610 | 1 | 1 | 1,315 | 3,331,520 | 34.0 |
| | | • GS (345/346), 1982 | 7,500 | 1 | 2 | 104 | 1,225,935 | 35.0-38.0 |
| | | • GS (365), 1980 | 10,140 | 1 | 1 | 314 | 679,175 | 42.0 |
| | | • GS (381), 1985 | 8,700 | 1 | 1 | 1,123 | 1,333,873 | 37.0 |
| | | • GS-327, 1983 | 5,600 | 1 | 1 | 1,493 | 2,621,126 | 20.0 |
| | | • Hilal (404), 1982 | 9,200-10,000 | 8 | 9 | 30,562 | 57,463,365 | 32.0 |
| | | • July, 1973 | 8,100-10,000 | 27 | 43 | 50,979 | 490,674,420 | 33.0 |
| | | NAG-9/9-1, 1985 | 10,000 | 1 | 2 | 886 | 1,624,363 | 35.0 |
| | | NEAG-9/15, 1984 | 10,635-12,128 | ... | 3 | 608 | 1,051,734 | 35.0 |
| | | • Nessim (336), 1981 | 6,700 | 1 | 3 | 48 | 8,88[illegible]592 | 29.0 |
| | | • October + 173 + 183, 1978 | 11,000 | 28 | 35 | 128,096 | 369,875,769 | 27.0-31.0 |
| | | • Ramadan, 1974 | 11,400 | 26 | 30 | 45,857 | 395,630,301 | 30.5 |
| | | Razzak and E. Razzak, 1972 | 5,730- 7,710 | 12 | 17 | 3,145 | 53,292,886 | 38.0 |
| | | • SB (305), 1981 | 8,100 | ... | 1 | ... | 2,043,837 | 27.0 |
| | | • SB (339), 1981 | 4,600 | 1 | 1 | 384 | 839,058 | 29.5 |
| | | • SB (367), 1984 | 7,500 | 1 | 1 | 160 | 1,312,941 | 39.0 |
| | | • SB-294, 1986 | 11,600 | 1 | 2 | 2,675 | 2,014,927 | 30.5 |
| | | • SB-374, 1981 | ... | ... | ... | ... | 68,506 | ... |
| | | • SG-300, 1976 | 5,720- 6,200 | 2 | 4 | 5,453 | 22,193,965 | 24.0 |
| | | • Shoab Ali, 1978 | 4,700- 5,500 | 19 | 47 | 11,115 | 82,719,926 | 28.0-33.0 |
| | | • Sidki (382), 1977 | 10,500 | 5 | 7 | 5,642 | 42,761,720 | 34.0 |
| | | • Waly (356), 1982 | 6,900 | 1 | 3 | 854 | 4,248,192 | 36.0 |
| | | WD-33, 1972 | 9,700 | ... | 1 | ... | 2,161,591 | 35.0 |
| | | WD-33/15, 1985 | 5,800 | 2 | 2 | 1,908 | 2,273,047 | 30.0 |
| | | • Younis (347), 1981 | 4,300 | 2 | 6 | 4,343 | 15,576,279 | 32.0 |
| | **AGIP** | • Belayim Land + Minori, 1954 | 7,000- 8,500 | 105 | 111 | 12,471 | 432,550,120 | 2.5 |
| | | Belayim Marine, 1961 | 8,500 | 66 | 74 | 48,685 | 627,689,302 | 9.5 |
| | | Meleiha, 1972 | 5,950 | 45 | 54 | 4,490 | 11,880,858 | 1.6 |
| | **WEPCO/PHILLIPS PETROLEUM** | El Alamein, 1966 | 8,700 | 18 | 19 | 1,660 | 67,537,121 | 34.0 |
| | | Umbarka, 1976 | 10,700 | 4 | 5 | 2,739 | 7,814,579 | 44.0 |
| | | Yidma, 1971 | 9,000 | 3 | 5 | 275 | 21,996,603 | 43.6 |
| | **KHALDA** | Hayat, 1986 | 9,000 | 5 | 5 | 887 | 750,513 | 40.0 |
| | | Khalda, 1983 | 7,000 | 6 | 13 | 2,852 | 2,800,466 | 35.0 |
| | | Safir, 1986 | 12,000 | 1 | 1 | 528 | 408,234 | 36.0 |
| | | Safir North, 1986 | 11,600 | 3 | 3 | 1,863 | 1,573,662 | 36.0 |
| | | Salam, 1985 | 8,000 | 18 | 29 | 13,420 | 14,680,848 | 35.0 |
| | | Tut, 1987 | 9,000 | 5 | 5 | 1,805 | 1,3[illegible]98 | 35.0 |
| | | Tut West, 1988 | 9,000 | 1 | 1 | 278 | 170,132 | 35.0 |
| | **BADR PETROLEUM/SHELL** | Badr el din, 1982 | 10,800 | 10 | 10 | 17,800 | 27,300,000 | 38.0 |
| | **SUESSO (ESSO)[e]** | • East Zeit, 1982 | 11,000 | 6 | 6 | – | | 38.0 |
| | **SUCO[e]** | • Ras Budran, 1978 | 12,500 | 17 | 20 | | | 23.0-24.0 |
| | | • LL 87-2, 1975 | 12,000 | ... | 1 | | | 34.0 |
| | | • Ras Fanar, 1978 | 3,000 | 5 | 6 | | | 30.0 |
| | | • Zeit Bay, 1981 | 6,000 | 22 | 32 | | | 34.5 |
| | **OSOCO/TOTAL[e]** | • Shukheir Bay, 1978 | 6,300 | 1 | 1 | | | 34.5 |
| | | • S. Ramadan, 1982 | 10,000 | 2 | 2 | | | 36.5 |
| | **GEYSUM[e]** | • Geysum, 1980 | 5,500 | 5 | 5 | | | 17.0 |
| | **EGPC[e]** | Gharib, 1938 | 2,200- 4,500 | 81 | 215 | | | 24.3 |
| | | Bakr/W. Bakr, 1958/1978 | 3,200- 1,500 | 48 | 83 | | | 18.0-19.0 |
| | | Umel Yusr, 1968 | 3,000- 3,300 | 19 | 37 | | | 21.5 |
| | | Amer, 1965 | 3,500 | 21 | 39 | | | 21.5 |
| | | El Ayoun, 1968 | 3,300 | 5 | 12 | | | 22.0 |
| | | Kareem, 1958 | 2,300 | 6 | 35 | | | 16.6 |
| | | Kheir, 1973 | 1,050 | 1 | 4 | | | 28.5 |
| | | Shukheir, 1966 | 2,500 | 5 | 11 | | | 34.0 |

|  |  |  |  | No. of wells |  | Production |  |  |
|---|---|---|---|---|---|---|---|---|
|  |  | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|  |  | Ras El Behar, 1983 | 4,500 | 6 | 11 | 308,810 | 873,086,730 | 32.5 |
|  |  | Esh Elmaiaha | 3,700 | 2 | 2 |  |  | 44.0 |
|  |  | Sudr, 1946 | 2,600 | 12 | 20 |  |  | 21.6 |
|  |  | Asl, 1947 | 3,000 | 3 | 6 |  |  | 21.6 |
|  |  | Matarma, 1948 | 2,000 | 2 | 2 |  |  | 14.6 |
|  |  | El Khaligue, 1980 | 1,600 | ... | 1 |  |  | 29.4 |
|  |  | Abu Senan T&Y, 1981 | 6,000 | 12 | 20 |  |  | ... |
|  |  | Harghada, 1913 | ... | NA | NA |  |  | ... |
|  | EPEDECO(e) | West Bakr, 1978 | 1,300- 1,500 | 20 | 25 |  |  | 18.0 |
|  | EGYPTCO(e) | Meleha, 1972 | 6,000 | 12 | 12 |  |  | 40.0 |
|  | SHUKAIR MARINE CO.(e) | O. Suco | ... | 1 | 1 |  |  | ... |
|  | EL ALAMEIN(e) | Mors | ... | 1 | 1 |  |  | ... |
|  |  | **Total Egypt** |  | **896** | **1,364** | **851,000** | **4,893,342,044** |  |
| **FRANCE** | **ALSACE** | All fields | ... | 14 | 21 | 290 | 3,158,398 | ... |
|  |  | Abandoned | ... | ... | ... | ... | 24,337,343 | ... |
|  | **AQUITAINE BASIN** | Castéra-Lou, 1976 | 9,600 | 8 | 11 | 382 | 2,614,350 | 21.7 |
|  |  | Cazaux, 1959 | 7,550 | 36 | 73 | 4,451 | 71,106,450 | 34.2-37.3 |
|  |  | Lacq Superieur, 1949 | 2,170 | 45 | 71 | 969 | 26,213,311 | 22.3 |
|  |  | Lagrave, 1984 | 6,500 | 3 | 3 | 6,010 | 8,017,894 | 42.5 |
|  |  | Lavergne, 1962 | 11,480 | 4 | 6 | 338 | 12,395,156 | 41.7 |
|  |  | Lugos, 1956 | 5,250 | 16 | 25 | 461 | 10,297,730 | 20.8 |
|  |  | Parentis, 1954 | 7,710 | 47 | 101 | 5,250 | 199,906,994 | 33.4 |
|  |  | Pecorade, 1974 | 10,660 | 7 | 20 | 1,901 | 10,631,201 | 29.3 |
|  |  | Vic Bilh, 1979 | 7,100 | 30 | 47 | 4,024 | 18,079,737 | 26.6 |
|  |  | Other | ... | 7 | 12 | 209 | 10,386,526 | ... |
|  |  | Abandoned | ... | ... | ... | ... | 8,848,690 | ... |
|  | **PARIS BASIN** | Champotran, 1985 | 8,400 | 8 | 13 | 877 | 881,462 | 31.1 |
|  |  | Châteaurenard, 1958 | 1,800 | 24 | 46 | 371 | 5,021,062 | 27.5 |
|  |  | Chaunoy, 1983 | 7,350 | 53 | 78 | 15,040 | 27,589,733 | 37.1 |
|  |  | Chuelles, 1961 | 1,800 | 31 | 68 | 372 | 7,135,011 | 27.5 |
|  |  | Coulommes, 1958 | 6,230 | 28 | 49 | 345 | 13,472,866 | 32.6 |
|  |  | Donmartin-Lettree, 1985 | 7,020 | 2 | 3 | 578 | 585,756 | 35.0 |
|  |  | Donnemarie, 1979 | 8,040 | 1 | 7 | 395 | 2,196,663 | 36.2 |
|  |  | Fontaine-au-Bron, 1986 | 6,140 | 10 | 12 | 2,280 | 1,366,704 | 35.4 |
|  |  | L'ile Du Gord, 1986 | 7,260 | 6 | 6 | 539 | 337,188 | 35.0 |
|  |  | Soudron, 1976 | 4,600 | 22 | 29 | 381 | 2,223,037 | 34.4 |
|  |  | St. Firmin, 1960 | 1,800 | 32 | 62 | 497 | 10,148,632 | 27.5 |
|  |  | St. Germain, 1984 | 7,200 | 7 | 15 | 955 | 2,285,843 | 36.0 |
|  |  | St. Martin, 1959 | 4,590 | 9 | 13 | 271 | 8,559,539 | 33.0 |
|  |  | Vert Le Grand, 1986 | 6,230 | 5 | 6 | 3,213 | 2,418,782 | 34.8 |
|  |  | Villeperdue, 1959 | 6,100 | 99 | 139 | 12,695 | 21,412,160 | 34.4 |
|  |  | Other | ... | 78 | 156 | 2,461 | 13,241,027 | ... |
|  |  | Abandoned | ... | ... | ... | ... | 14,293,157 | ... |
|  | **SOUTHEAST + JURA** | All fields abandoned | ... | ... | ... | ... | 223,063 | ... |
|  |  | **Total France** |  | **632** | **1,092** | **65,555** | **539,385,465** |  |
| **GABON** | **ELF** | ● Anguille, 1962 | 9,200 |  |  |  |  | 31.0 |
|  |  | ● Anguille W, 1968 | 7,500 |  |  |  |  | 32.3 |
|  |  | ● Anguille SE, 1962 | 8,200 |  |  |  |  | 33.0 |
|  |  | ● Ayol Marine, 1979 | 7,700 |  |  |  |  | 19.8 |
|  |  | ● Baliste, 1974 | 4,900 |  |  |  |  | 27.5 |
|  |  | ● Barbier, 1972 | 6,000 |  |  |  |  | 32.6 |
|  |  | ● Batanga, 1960 | 5,900 |  |  |  |  | 39.2 |
|  |  | ● Baudroie Marine, 1968 | 7,500 |  |  |  |  | 29.7 |
|  |  | ● Baudroie N., 1980 | 7,500 |  |  |  |  | 31.5 |
|  |  | ● Breme, 1976 | 5,000 |  |  |  |  | 37.0 |
|  |  | ● Clairette, 1956 | 4,400 |  |  |  |  | 32.5 |
|  |  | ● Dorée, 1972 | 7,300 |  |  |  |  | 30.4 |
|  |  | ● Girelle, 1973 | 9,400 |  |  |  |  | 31.1 |
|  |  | ● Gonelle, 1972 | 5,800 | 218 | 305 | 101,215 | 983,072,000 | 25.7 |
|  |  | ● Grand-Anguille, 1983 | 8,400 |  |  |  |  | 31.1 |
|  |  | ● Grondin Marine, 1971 | 7,500 |  |  |  |  | 26.6 |
|  |  | ● Konzi, 1962 | 3,600 |  |  |  |  | 39.0 |
|  |  | ● M'Bya Sud, 1969 | 6,700 |  |  |  |  | 36.2 |
|  |  | ● Mandaros, 1973 | 4,900 |  |  |  |  | 20.5 |
|  |  | ● Mérou-Sardine, 1981 | 9,900 |  |  |  |  | 30.2 |
|  |  | Olendé, 1976 | 6,700 |  |  |  |  | 34.0 |
|  |  | ● Pageau, 1972 | 11,500 |  |  |  |  | 19.8 |
|  |  | ● Port-Gentil Sud Marine, 1975 | 7,500 |  |  |  |  | 32.1 |
|  |  | Tchengué, 1957 | 4,100 |  |  |  |  | 31.0 |
|  |  | ● Tchengue-Océan, 1962 | 6,600 |  |  |  |  | 30.2 |
|  |  | ● Torpille, 1968 | 8,200 |  |  |  |  | 34.0 |
|  |  | ● Torpillo NE, 1968 | 8,200 |  |  |  |  | 32.3 |
|  | **SHELL GABON** | Gamba/Ivinga, 1963 | 3,000- 3,100 | 51 | 84 | 10,685 | 262,600,000 | 31.6 |
|  |  | Lucina, 1971 | 5,900 | 15 | 22 | 7,123 | 53,800,000 | 38.4 |
|  |  | Lucina W., 1982 | ... | ... | ... | 822 | 2,300,000 | 38.4 |

| | | Name of field, discovery date | Depth, ft | No. of wells | | Production | | °API gravity |
|---|---|---|---|---|---|---|---|---|
| | | | | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | |
| | AMOCO | Oguendjo B, C, and Z, 1981 | 5,000- 6,000 | 17 | 19 | 13,127 | 38,091,408 | 36.0 |
| | BRITISH GAS | ● Obando, 1984 | 8,650 | 2 | 2 | 3,016 | 1,912,000 | 32.0 |
| | | ● Octopus, 1984 | 10,300 | 3 | 3 | 711 | 1,166,000 | 33.0 |
| | | ● Pelican, 1985 | 9,300 | 4 | 4 | 7,432 | 6,004,000 | 31.0 |
| | | **Total Gabon** | | 310 | 439 | 144,131 | 1,348,945,408 | |
| **GHANA** | AGRI-PETCO | ● Saltpond, 1977 | 8,500 | ... | 3 | ... | 3,938,000 | 36.0-39.0 |
| | | **Total Ghana** | | ... | 3 | ... | 3,938,000 | |
| **GREECE** | N. AEGEAN PET. CORP. | ● Prinos, 1974 | 8,000- 9,700 | 13 | 15 | 18,222 | 70,372,217 | 28.5 |
| | | **Total Greece** | | 13 | 15 | 18,222 | 70,372,217 | |
| **GUATEMALA** | MINISTERIO DE ENERGIA Y MINAS | Caribe, 1981 | 6,830 | 3 | 3 | 1,117 | 3,053,148 | 22.0-24.0 |
| | | Rubelsanto, 1974 | 5,300 | 5 | 7 | 1,072 | 6,127,188 | 26.0-30.0 |
| | | San Diego, 1981 | 17,150 | .. | 1 | ... | 135,865 | 35.0 |
| | | Tierra Blanca | 11,230 | 1 | 1 | 760 | 209,097 | 19.5-23.0 |
| | | Tortugas, 1973 | 2,300 | ... | ... | ... | 67,800 | 25.0 |
| | | West Chinaja, 1977 | 3,200- 3,800 | 3 | 3 | 466 | 7,337,899 | 31.0-35.0 |
| | | Xan, 1985 | 8,427 | 1 | 1 | 361 | 131,773 | 17.0 |
| | | Yalpemech, 1980 | 15,351 | 1 | 1 | 84 | 136,957 | 31.0-35.0 |
| | | **Total Guatemala** | | 14 | 17 | 3,860 | 17,199,727 | |
| **INDIA** | GUJARAT STATE | Ankleshwar, 1960 | 1,969- 6,564 | 138 | 262 | 16,962 | 449,130,000 | 45.0 |
| | | Gandhar, 1984 | 9,846-12,145 | 30 | 52 | 15,037 | 9,320,000 | 47.0 |
| | | Kadi, N., 1967 | 3,610- 7,220 | 160 | 227 | 13,557 | 11,578,000 | 21.0 |
| | | Kadi, S., 1968 | 6,892- 9,846 | 6 | 39 | 641 | 3,812,000 | 24.0 |
| | | Kalol, 1961 | 4,595-10,830 | 152 | 322 | 11,719 | 42,278,000 | 38.0 |
| | | Nawagam, 1963 | 4,595-10,174 | 74 | 130 | 2,733 | 26,832,000 | 31.0 |
| | | Sanand, 1962 | 4,267-10,174 | 22 | 88 | 2,095 | 10,317,000 | 26.0 |
| | | Sobhasan, 1968 | 4,595- 9,846 | 59 | 124 | 12,460 | 25,714,000 | 26.0-40.0 |
| | | Viraj, 1978 | 4,595- 4,923 | 20 | 37 | 3,700 | 5,148,000 | 20.0 |
| | ASSAM STATE | Geleki, 1968 | 9,518-14,769 | 62 | 161 | 9,144 | 40,579,000 | 30.0 |
| | | Lakwa-Lakhmani, 1964 | 6,564-14,113 | 211 | 344 | 37,419 | 154,469,000 | 33.0 |
| | | Rudrasagar, 1960 | 7,877-13,128 | 50 | 111 | 10,689 | 37,708,000 | 25.0 |
| | WEST COAST | ● B-38 (Heera), 1977 | 4,267- 6,564 | 40 | 76 | 28,836 | 56,379,000 | 37.0 |
| | | ● Bombay High, 1974 | 3,282- 7,877 | 304 | 450 | 420,179 | 1,255,890,000 | 39.0 |
| | | ● Panna (North Bassein), 1976 | 4,923- 7,549 | 7 | 23 | 2,978 | 1,691,000 | 38.0 |
| | | ● Ratna, 1979 | 7,500 | 5 | 14 | 1,307 | 957,000 | 38.0 |
| | NAGALAND & TAMIL NADU | Changpang, 1973 | 8,861-10,502 | 9 | 17 | 3,002 | 4,857,000 | 34.0 |
| | | Narimanam, 1985 | 6,236- 7,549 | 8 | 25 | 2,818 | 1,258,000 | 45.0 |
| | OTHER FIELDS | Bakrol, 1966 | 2,626- 9,846 | ... | 3 | ... | 37,000 | ... |
| | | Digboi, 1980 | 300- 7,500 | 234 | 462 | 570 | 86,156,400 | ... |
| | | Jorajan, 1967 | 7,000-11,500 | 126 | 187 | 23,248 | 52,560,000 | 25.0-34.0 |
| | | Kathana, 1965 | 5,250- 5,906 | 13 | 33 | 547 | 5,103,000 | 25.0 |
| | | Kholka, 1966 | 5,579- 7,877 | 12 | 19 | 144 | 636,000 | ... |
| | | Kosamba, 1963 | 1,313- 8,533 | 6 | 23 | 393 | 978,000 | ... |
| | | Moran, 1958 | 11,000 | 61 | 89 | 8,286 | 109,287,600 | ... |
| | | Nakhorkatiya, 1953 | 9,500 | 135 | 325 | 21,367 | 367,974,000 | ... |
| | | Wavel, 1962 | 4,595- 7,220 | ... | ... | ... | 168,000 | ... |
| | | **Total India** | | 1,944 | 3,643 | 649,831 | 2,760,817,000 | |
| **INDONESIA** | PERTAMINA UEP I(e) | Besitang, 1977 | 3,973 | 204 | 226 | | | 51.5 |
| | | Gebang, 1977 | 2,917 | | | | | 54.0 |
| | | K. Simpang, 1971 | 3,740- 5,019 | | | | | 45.0 |
| | | P. Tabuhan, 1937 | 3,350- 5,893 | | | | | 50.8 |
| | | Rantau, 1929 | 2,764 | | | | | 45.3 |
| | | Serang Jaya, 1926 | 3,701 | | | | | 47.5 |
| | PERTAMINA UEP II(e) | Benuang, 1942 | 6,103 | 412 | 1,419 | | | 35.1 |
| | | Benakat East, 1973 | NA | | | | | NA |
| | | Tempino, 1931 | 1,647 | | | | | 23.0 |
| | | Gn. Kemala, 1938 | 5,448 | | | | | 38.0 |
| | | Limau, 1928 | 3,896- 4,626 | | | | | NA |
| | | Ogan Timur, 1943 | 3,793 | | | | | 27.42 |
| | | Talang Jimar, 1937 | 4,123 | | | | | 31.0 |
| | | T. Miring, 1935 | 640 | | | | | NA |
| | | Tanjung Tiga, 1938 | 3,750 | | | | | 28.0 |
| | | Kenali Asam, 1931 | 2,077 | | | | | 29.0 |
| | | Belimbing | 5,371 | | | | | ... |
| | | Kuang, 1940 | 5,249 | | | | | 25.1 |
| | PERTAMINA UEP III(e) | Cemara, 1976 | 3,964- 7,104 | 88 | 184 | | | ... |
| | | Jatibarang, 1969 | 3,063 | | | | | 29.0 |
| | | Tugu Barat, 1979 | 3,014 | | | | | ... |
| | PERTAMINA UEP IV(e) | Bunyu, 1923 | 2,077 | | | | | 33.2 |
| | | Sangatta, 1939 | 1,842 | | | | | 33.0 |

| | Name of field, discovery date | Depth, ft | No. of wells Producing | No. of wells Total | Production 1989 average B/d | Production Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|---|---|---|---|---|---|---|---|
| | Tanjung, 1938 | 2,296 | 161 | 334 | 7,701 | 2,955,200,548 | 39.9 |
| | Tapian Timur, 1967 | 4,396 | | | | | 38.8 |
| | Warukin S., 1966 | 2,067 | | | | | 26.9 |
| **PERTAMINA UEP V[e]** | Klamono, 1936 | 574 | | | | | 19.0 |
| | Linda, 1977 | 3,281 | 47 | 55 | | | 19.0 |
| | Sele, 1951 | 2,156 | | | | | 35.0 |
| **PERTAMINA (FROM STANVAC)[e]** | Sago, 1940 | 1,800 | | | | | 34.0 |
| | Lirik, 1939 | 1,600 | | | | | 34.0 |
| | Molek, 1956 | 2,600 | | | | | 34.0 |
| | N. Pulai, 1941 | 1,800 | | | | | 34.0 |
| | S. Pulai, 1941 | 1,800 | 354 | 354 | | | 34.0 |
| | Talang Akar, 1922 | 2,800 | | | | | 35.0 |
| | Benakat, 1932 | 1,600 | | | | | 35.0 |
| | Jirah, 1930 | 2,300 | | | | | 35.0 |
| | Rajah, 1940 | 6,000 | | | | | 38.0 |
| | Abab, 1951 | 6,000 | | | | | 36.0 |
| **PERTAMINA (N.E. KALIMANTAN)[e]** | Sembakung, 1976 | 2,600 | 17 | 19 | | | 36.0 |
| | Bangkudulis, 1980 | 3,250 | ... | 1 | | | 39.5 |
| **PERTAMINA (FROM PHILLIPS)[e]** | Salawati, 1976 | 5,749 | 7 | 13 | | | 39.2 |
| **LEMIGAS[e]** | All fields, 1893-1909 | 2,155- 2,297 | 71 | 419 | | | ... |
| **TOTAL CFP[e]** | ● Tambora, 1980 | 8,000-13,000 | 15 | 34 | | | 33.0 |
| | ● Handil, 1974 | 2,900- 9,000 | 219 | 272 | | | 33.0 |
| | ● Bekapai, 1972 | 4,600- 5,600 | 42 | 45 | | | 40.0 |
| **ARCO** | Ardjuna, 1969 | 2,360- 7,250 | 300 | 356 | 99,438 | 722,948,500 | 37.0 |
| | Arimbi, 1972 | 2,943 | 27 | 30 | 9,919 | 29,953,200 | 33.0 |
| | NWC, 1974 | 5,411-5,800 | 17 | 30 | 5,746 | 7,041,700 | 31.5 |
| | Bima, 1983 | 3,000- 3,358 | 48 | 60 | 11,947 | 15,896,200 | 34.0 |
| **AGL PETROLEUM (SERAM) LTD.** | Bula, 1897 | 280- 1,300 | 131 | 69 | 1,295 | 15,542,593 | 23.0 |
| **CHEVRON & TEXACO** | Batang, 1975 | 690 | 12 | 13 | 701 | | 19.0 |
| | Benua, 1978 | 2,400 | 21 | 25 | 10,114 | | 37.0 |
| | Beruk, 1974 | 1,750 | 19 | 28 | 8,813 | | 38.0 |
| | Beruk NE, 1976 | 1,800 | 3 | 6 | 138 | | 40.0 |
| | Beruk North, 1985 | 1,900 | 5 | 7 | 1,174 | | 38.0 |
| | Buaya, 1978 | 2,035 | ... | 2 | ... | | 28.0 |
| | Butun, 1982 | 4,000 | 9 | 9 | 5,781 | | 44.0 |
| | Damar, 1974 | 4,650 | 5 | 6 | 511 | | 34.0 |
| | Dusun, 1979 | 2,550 | 6 | 7 | 1,008 | | 42.0 |
| | Gatam, 1977 | 2,385 | ... | 3 | ... | | 34.0 |
| | Idris, 1982 | 2,450 | 1 | 3 | 815 | | 39.0 |
| | Kasikan, 1972 | 660 | 20 | 27 | 1,156 | | 28.0 |
| | Jingga, 1984 | 6,500 | 3 | 3 | 1,596 | | 45.0 |
| | Langgak, 1976 | 1,380 | 26 | 27 | 2,340 | | 32.0 |
| | Lindai, 1971 | 1,100 | 18 | 20 | 1,386 | | 32.0 |
| | Menggala S., 1968 | 3,765 | 2 | 3 | 755 | | 34.0 |
| | Mengkapan, 1981 | 4,000 | 1 | 1 | 767 | | 44.0 |
| | Osam, 1978 | 900 | 6 | 6 | 298 | | 32.0 |
| | Paitan, 1978 | 2,315 | 1 | 1 | 232 | | 32.0 |
| | Pedada, 1973 | 950 | 30 | 31 | 11,032 | | 33.0 |
| | Pusaka, 1977 | 2,250 | 20 | 23 | 5,985 | | 36.0 |
| | Rintis, 1984 | 6,450 | 1 | 1 | 387 | | 39.7 |
| | Sabak, 1974 | 2,350 | 15 | 17 | 1,650 | | 36.0 |
| | Tanjung Medan, 1976 | 2,770 | 2 | 7 | 846 | | 34.0 |
| | Terantam, 1973 | 900 | 2 | 4 | 109 | | 32.0 |
| | Zamrud, 1975 | 3,600 | 52 | 54 | 19,295 | | 40.0 |
| **CALTEX PACIFIC INDONESIA** | Central Sumatra, Aman, 1974 | 4,700 | 10 | 10 | 1,360 | | 39.0 |
| | Ampuh, 1981 | 6,000 | 12 | 12 | 2,825 | | 38.0 |
| | Antara, 1978 | 1,425 | 5 | 6 | 939 | | 36.0 |
| | Balam S., 1969 | 1,600 | 59 | 62 | 9,141 | | 33.0 |
| | Balam SE, 1972 | 4,500 | 13 | 13 | 666 | | 29.0 |
| | Bangko, 1970 | 1,950 | 86 | 96 | 28,311 | | 34.0 |
| | Batang CPI, 1975 | 690 | 6 | 7 | 370 | | 19.0 |
| | Bekasap, 1955 | 2,950 | 56 | 63 | 18,708 | | 34.0 |
| | Bekasap South, 1968 | 3,900 | 9 | 14 | 1,199 | | 34.0 |
| | Benar, 1973 | 2,450 | 26 | 30 | 4,778 | | 33.0 |
| | Cebakan, 1974 | 4,700 | 4 | 5 | 627 | | 30.0 |
| | Cucut, 1981 | 5,800 | 3 | 3 | 221 | | 33.0 |
| | Duri, 1941 | 770 | 1,465 | 1,844 | 134,071 | | 22.0 |
| | Garuk, 1980 | 4,600 | ... | 2 | ... | | 31.0 |
| | Hitam, 1975 | 6,690 | 4 | 5 | 979 | | 39.0 |
| | Hiu, 1983 | 5,900 | 4 | 4 | 1,125 | | 40.0 |
| | Intan, 1977 | 3,350 | 6 | 7 | 1,866 | | 33.0 |
| | Jorang, 1972 | 5,500 | 19 | 21 | 11,612 | | 38.0 |
| | Kerang, 1977 | 3,900 | 11 | 14 | 1,032 | | 39.0 |
| | Kopar, 1974 | 5,300 | 20 | 23 | 3,696 | | 37.0 |
| | Kotabatak, 1952 | 5,500 | 68 | 113 | 18,818 | | 29.0 |
| | Kulin, 1970 | 2,050 | 60 | 68 | 4,996 | | 20.0 |
| | Libo, 1968 | 6,000 | 2 | 12 | 1,401 | | 35.0 |
| | Libo SE, 1973 | 5,900 | 20 | 27 | 7,458 | | 42.0 |

| | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|
| | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | Lincak, 1981 | 2,570 | 4 | 4 | 323 | 6,749,434,683 | 35.0 |
| | Menggala N., 1968 | 3,850 | 16 | 20 | 4,336 | | 33.0 |
| | Menggala S. CPI, 1968 | 3,765 | 6 | 7 | 1,449 | | 34.0 |
| | Minas, 1944 | 2,600 | 467 | 618 | 232,966 | | 35.0 |
| | Mindal, 1971 | 3,400 | 2 | 4 | 37 | | 37.0 |
| | Mutiara, 1976 | 3,500 | 2 | 2 | ... | | 34.0 |
| | Nella, 1977 | 5,000 | 3 | 5 | 33 | | 35.0 |
| | Obor, 1978 | 7,370 | 2 | 2 | 201 | | 40.0 |
| | Pager, 1974 | 4,300 | 25 | 27 | 6,930 | | 38.0 |
| | Pelita, 1977 | 6,600 | 7 | 7 | 627 | | 39.0 |
| | Pematang, 1959 | 3,750 | 40 | 46 | 8,538 | | 32.0 |
| | Pematang Bow, 1969 | 5,300 | 7 | 14 | 1,997 | | 33.0 |
| | Pemburu, 1981 | 2,300 | 9 | 10 | 2,738 | | 35.0 |
| | Perkebunan, 1977 | 2,300 | 1 | 1 | ... | | 29.0 |
| | Petani, 1964 | 4,750 | 31 | 34 | 11,419 | | 33.0 |
| | Petapahan, 1971 | 4,500 | 23 | 30 | 5,051 | | 28.0 |
| | Pinang, 1971 | 3,950 | 19 | 22 | 4,690 | | 30.0 |
| | Pinggir, 1972 | 3,300 | 3 | 7 | 268 | | 35.0 |
| | Pinggir S., 1973 | 3,300 | 2 | 4 | 59 | | 39.0 |
| | Pudu, 1972 | 5,950 | 8 | 13 | 1,060 | | 35.0 |
| | Pukat, 1983 | 6,200 | 2 | 2 | 813 | | 40.0 |
| | Puncak, 1979 | 2,400 | 14 | 16 | 3,788 | | 36.0 |
| | Pungut, 1951 | 3,400 | 27 | 33 | 4,202 | | 38.0 |
| | Rangau, 1968 | 6,100 | 4 | 12 | 113 | | 42.0 |
| | Rantaubais, 1972 | 1,070 | 14 | 18 | 541 | | 18.0 |
| | Rokiri, 1979 | 6,100 | ... | 4 | ... | | 41.0 |
| | Seruni, 1972 | 3,000 | 23 | 25 | 6,796 | | 35.0 |
| | Sikladi, 1975 | 4,340 | 19 | 21 | 2,869 | | 40.0 |
| | Singa, 1977 | 3,200 | 1 | 1 | 32 | | 31.0 |
| | Sintong, 1971 | 3,400 | 22 | 23 | 3,497 | | 32.0 |
| | Sintong SE, 1973 | 4,500 | 1 | 1 | 78 | | 36.0 |
| | Suram, 1971 | 1,750 | 4 | 7 | 238 | | 28.0 |
| | Tandun, 1969 | 3,000 | 12 | 13 | 2,675 | | 33.0 |
| | Telinga, 1975 | 4,205 | 7 | 10 | 603 | | 33.0 |
| | Topaz, 1977 | 5,200 | 7 | 8 | 1,558 | | 33.0 |
| | Topi, 1979 | 3,630 | 1 | 1 | 3 | | 37.0 |
| | Tunas, 1983 | 4,819 | 2 | 2 | 101 | | 35.0 |
| | Ubi, 1976 | 4,350 | 24 | 25 | 2,878 | | 35.0 |
| | Waduk, 1982 | 6,100 | 9 | 11 | 212 | | 38.0 |
| **ASAMERA (NORTH SUMATRA)** | Alur Cimon, 1972 | 3,098 | ... | 24 | ... | 1,378,939 | 50.8 |
| | Geudondong, 1965 | 3,192 | ... | 23 | ... | 5,199,661 | 53.1 |
| | Iee Tabeu, 1971 | 2,721 | 1 | 47 | 33 | 11,903,005 | 50.3 |
| | Julu Rayeu, 1968 | 2,832 | 7 | 47 | 138 | 12,422,881 | 53.6 |
| | Peudawa, 1980 | 3,083 | ... | 10 | ... | 1,567,420 | 48.1 |
| | Tualang, 1973 | 2,631 | 11 | 58 | 1,021 | 30,856,147 | 49.9 |
| **ASAMERA (SOUTH SUMATRA)** | Bentayan, 1932 | 4,446 | 16 | 18 | 2,037 | 2,366,357 | 22.0 |
| | Kluang, 1913 | 2,591 | 26 | 70 | 476 | 34,233,038 | 42.6 |
| | Mangunjaya, 1934 | 2,700 | 5 | 102 | 152 | 23,141,435 | 32.0 |
| | Panerokan, 1976 | 4,915 | 2 | 5 | 21 | 206,837 | 39.4 |
| | Ramba, 1982 | 3,150 | 62 | 74 | 12,288 | 55,475,598 | 37.0 |
| | Rawa, 1985 | 4,038 | 26 | 34 | 6,138 | 6,487,085 | 38.7 |
| | Tanjung Laban, 1982 | 3,590 | 21 | 29 | 3,994 | 8,162,791 | 38.1 |
| | Tempino, 1931 | 4,493 | 3 | 6 | 128 | 1,447,940 | 40.9 |
| | Keri, 1985 | 3,957 | 2 | 2 | 67 | 103,940 | 41.5 |
| | Supat, 1984 | 4,626 | 11 | 11 | 1,679 | 984,286 | 33.6 |
| | South Rawa, 1985 | 4,086 | 2 | 3 | 76 | 69,888 | 37.0 |
| **MAXUS ENERGY** | • Cinta, 1970 | 3,500 | 41 | 50 | 11,689 | 180,237,816 | 34.0 |
| | • Duma, 1983 | 2,300 | 2 | 6 | 135 | 747,577 | 24.0 |
| | • Farida, 1982 | 8,000 | 15 | 22 | 3,348 | 12,854,871 | 32.0 |
| | • Gita, 1972 | 5,000 | 5 | 9 | 623 | 7,732,447 | 34.5 |
| | • Intan, 1989 | ... | 9 | 9 | 17,910 | 6,537,400 | 32.6 |
| | • Karmila, 1983 | 4,800 | 6 | 9 | 7,095 | 32,317,970 | 36.0 |
| | • Kitty, 1973 | 2,700 | 7 | 7 | 1,120 | 14,382,111 | 38.0 |
| | • Krisna, 1979 | 4,500 | 31 | 41 | 7,017 | 62,216,480 | 37.0 |
| | • Nora, 1973 | 3,200 | 4 | 5 | 424 | 8,962,055 | 29.0 |
| | • Rama, 1974 | 3,200 | 40 | 76 | 6,498 | 93,558,502 | 31.0 |
| | • Selatan, 1971 | 4,000 | 8 | 19 | 1,030 | 21,173,656 | 19.0 |
| | • Sundari, 1982 | 4,400 | 12 | 15 | 2,630 | 11,825,368 | 25.0 |
| | • Titi, 1982 | 8,000 | 1 | 4 | 10 | 1,636,220 | 33.0 |
| | Wanda, 1984 | 4,800 | 2 | 5 | 140 | 1,636,933 | 36.0 |
| | • Yvonne, 1980 | 4,500 | 8 | 11 | 3,023 | 13,724,355 | 36.0 |
| | • Zelda, 1971 | 7,500 | 30 | 45 | 6,899 | 39,165,810 | 33.0 |
| **PETROMER TREND** | Cenderawasih, 1976 | 3,500 | 18 | 24 | 1,554 | 12,861,066 | 26.7 |
| | Jaya, 1973 | 3,050 | 12 | 19 | 1,033 | 36,178,946 | 39.7 |
| | Kasim, 1972 | 3,350 | 38 | 54 | 3,475 | 48,509,708 | 36.5 |
| | Walio, 1975 | 2,750 | 210 | 288 | 13,312 | 156,932,595 | 34.3 |
| | Other | ... | 12 | 21 | 998 | 12,686,379 | ... |
| **STANVAC (CENTRAL SUMATRA)** | Binio, 1972 | 1,600 | 19 | 19 | 423 | 11,975,355 | 34.0 |
| | E. Kayuara, 1983 | 3,500 | 45 | 45 | 4,010 | 8,513,939 | 35.0 |
| | Gemuruh, 1983 | 2,800 | 14 | 16 | 968 | 2,740,506 | 34.0 |
| | Kayuara, 1982 | 3,700 | 7 | 9 | 337 | 2,150,314 | 35.0 |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Kerumutan, 1980 | 3,000 | 19 | 21 | 764 | 5,399,906 | 35.0 |
| | | Merbau, 1979 | 2,700 | 28 | 28 | 989 | 7,132,070 | 36.0 |
| | | Mutiara, 1985 | 2,700 | 2 | 2 | 48 | 132,620 | 34.0 |
| | | N. Merbau, 1980 | 2,600 | 8 | 8 | 278 | 2,936,676 | 36.0 |
| | | Parum, 1987 | 4,200 | 9 | 9 | 2,063 | 1,383,769 | 35.0 |
| | | Panduk, 1981 | 2,500 | 6 | 6 | 224 | 1,609,536 | 46.0 |
| | | Pekan, 1976 | 3,700 | 18 | 18 | 393 | 7,983,900 | 35.0 |
| | | Other | 4,600 | ... | ... | ... | 9,175 | 1.0 |
| | **STANVAC (SOUTH SUMATRA)** | Ibul, 1970 | 5,700 | 17 | 17 | 780 | 22,193,660 | 36.0 |
| | | Jene, 1985 | 6,500 | 22 | 25 | 23,765 | 21,443,720 | 35.0 |
| | | • Kerang (PSC), 1984. | 2,900 | 4 | 5 | 1,165 | 1,173,757 | 35.0 |
| | | Lagan, 1986 | 2,400 | 4 | 4 | 270 | 303,574 | 56.8 |
| | | Pian, 1986 | 6,000 | 3 | 3 | 92 | 97,189 | 36.0 |
| | | Rambutan, 1972 | 4,500 | 6 | 6 | 66 | 3,246,970 | 42.0 |
| | | Rimbabat (PSC), 1984 | 3,200 | 3 | 3 | 366 | 160,980 | 34.0 |
| | | • Tabuan (PSC) | 4,000 | 9 | 9 | 748 | 1,817,026 | 34.0 |
| | | Other | 4,500 | 6 | 6 | 1,060 | 2,383,653 | 1.0 |
| | **UNION TEXAS** | Badak, 1972 | 5,190-10,600 | 122 | 146 | 5,389 | 412,604,000 | 21.0 |
| | | Mutiara, 1984 | 900- 5,800 | 9 | 31 | 2,948 | 5,012,000 | 30.0 |
| | | Nilam, 1974 | 7,500-11,500 | 72 | 101 | 5,088 | 22,231,000 | 32.0 |
| | | Pamaguan, 1974 | 900- 5,100 | 13 | 26 | 2,197 | 7,424,000 | 30.0 |
| | | Semberah, 1974 | 2,900-10,100 | ... | 29 | ... | 7,000 | 35.0 |
| | **UNOCAL** | • Attaka, 1970 | 7,500 | 78 | 101 | 51,117 | 470,523,474 | 39.0 |
| | | • Kerindingan, 1972 | 7,000 | ... | 8 | 255 | 5,038,870 | 23.8 |
| | | • Melahin, 1972 | 7,500 | 4 | 6 | 750 | 6,787,008 | 23.1 |
| | | • Rajah, 1981 | 5,500 | 6 | 6 | 4,481 | 6,023,749 | 33.8 |
| | | • Sepinggan, 1973 | 11,150 | 16 | 20 | 4,707 | 45,421,589 | 34.0 |
| | | • Yakin, 1976 | 5,100 | 21 | 28 | 7,194 | 23,614,688 | 18.8 |
| | **CONOCO GROUP** | • Ikan Pari, 1983 | 4,500 | 4 | 4 | 2,164 | 790,031 | 47.0 |
| | | • Kepeting, 1982 | 6,000 | ... | 2 | 826 | 2,563,162 | 37.0 |
| | | • Udang, 1974 | 5,595 | 18 | 28 | 5,812 | 59,583,697 | 40.0 |
| | **MOBIL OIL** | Arun, 1971 | 10,000 | 46 | 62 | 124,267 | 381,192,417 | 55.0 |
| | **MARATHON** | • Kakap KH, 1980 | 8,500 | 8 | 8 | 6,900 | 15,559,000 | 45.0 |
| | | • Kapap KF, 1984 | 8,100 | 1 | 1 | 2,800 | 67,000 | 49.0 |
| | **HUDBAY (MALACCA STRAIT)** | • Kurau, 1986 | 4,500- 9,000 | 15 | 17 | 26,680 | 12,929,507 | 47.4 |
| | | • Lalang, 1980 | 3,100- 3,600 | 11 | 18 | 7,485 | 36,401,391 | 39.6 |
| | | • Melibur, 1984 | 900- 1,300 | 12 | 19 | 8,740 | 9,134,245 | 35.6 |
| | | • Mengkapan, 1981 | 3,850- 4,450 | 9 | 10 | 15,396 | 20,498,509 | 42.0 |
| | **TESORO INDONESIA PETROLEUM** | Samboja, 1909 | 360- 4,380 | 26 | 99 | 363 | 64,762,820 | 25.0 |
| | | Sanga Sanga, 1897 | 85- 6,000 | 108 | 244 | 2,540 | 268,598,560 | 31.0 |
| | | Tarakan, 1906 | 200- 6,540 | 122 | 1,167 | 1,785 | 211,485,507 | 19.0 |
| | **TARAKAN PETROLEUM** | Tarakan (Mamburungan field), 1984 | 5,020- 5,131 | 2 | 4 | 471 | 99,522 | 31.1 |
| | | **Total Indonesia** | | **6,963** | **11,568** | **1,231,000** | **13,229,992,628** | |
| **IRAN** | **NIOC** | • Aboozar, 1969 | 2,800 | ... | ... | 2,801,370 | 37,992,437,094 | 27.0 |
| | | Agha Jari, 1936 | 7,440 | 58 | 89 | | | 34.0 |
| | | Ahwaz Asmari, 1958 | 8,150 | 73 | 85 | | | 32.0 |
| | | Ahwaz Bangestan, 1958 | 12,000 | ... | 7 | | | 24.3 |
| | | • Bahregansar, 1960 | 9,000 | ... | ... | | | 30.0 |
| | | Bibi Hakimeh, 1961 | 4,570 | 19 | 33 | | | 29.9 |
| | | Binak, 1959 | 10,440 | ... | 4 | | | 29.9 |
| | | Chesmeh Khush, 1967 | 10,700 | ... | 4 | | | 27.7 |
| | | Chillingar, 1974 | 3,350 | ... | 1 | | | 39.3 |
| | | Dehluran, 1972 | 11,900 | ... | 6 | | | 31.0 |
| | | • Dorood, 1961 | 11,000 | ... | ... | | | 34.0 |
| | | • Forozan, 1966 | 7,000 | ... | ... | | | 28.5 |
| | | Gachsaran, 1937 | 3,400 | 46 | 62 | | | 31.0 |
| | | Haft Kel, 1927 | 1,980 | 2 | 11 | | | 37.7 |
| | | • Hendijan, 1968 | 11,000 | ... | ... | | | 23.0 |
| | | Karanj, 1963 | 5,360 | 7 | 7 | | | 33.9 |
| | | Kharg, 1961 | 10,900 | ... | ... | | | 31.6 |
| | | Kupal, 1965 | 10,500 | ... | 7 | | | 32.8 |
| | | Lab-e Safid, 1968 | 4,350 | ... | 7 | | | 35.3 |
| | | Mansuri, 1963 | 7,100 | 4 | 8 | | | 28.4 |
| | | Marun, 1963 | 9,400 | 55 | 112 | | | 32.6 |
| | | Masjid-e Suleiman, 1908 | 1,600 | 7 | 24 | | | 39.3 |
| | | Naft Safid, 1938 | 5,000 | 5 | 19 | | | 36.8 |
| | | Naft-Shahre, 1923 | 2,000- 3,000 | ... | ... | | | 43.0 |
| | | • Nowruz, 1966 | 8,200 | ... | ... | | | 21.0 |
| | | Parsi, 1964 | 4,670 | 22 | 27 | | | 38.8 |
| | | Par-e Siah, 1964 | 4,250 | ... | 1 | | | 37.7 |
| | | Pazanan, 1961 | 7,250 | 44 | 71 | | | 37.2 |
| | | Rag-e Safid, 1964 | 7,230 | 19 | 29 | | | 26.6 |
| | | Ramin, 1966 | 12,200 | ... | ... | | | 32.9 |
| | | Ramshir, 1962 | 8,750 | ... | 3 | | | 27.6 |
| | | • Resalat, 1969 | 7,650 | ... | ... | | | 35.8 |
| | | • Reshadat, 1966 | 7,000 | ... | ... | | | 34.4 |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | API gravity |
| | | Soroush, 1962 | 7,000 | ... | ... | | | 18.3 |
| | | Salman, 1965 | 7,500- 8,100 | ... | ... | | | 34.0 |
| | | Shadegan, 1989 | ... | ... | ... | | | ... |
| | | Sulabedar, 1971 | 3,400 | ... | 1 | | | 30.4 |
| | | **Total Iran** | | **361** | **618** | **2,801,370** | **37,992,437,094** | |
| **IRAQ(e)** | **INOC** | Abu Ghurab, 1971 | 9,800 | 12 | 16 | 2,897,000 | 21,671,213,000 | 24.0 |
| | | Ain Zalah, 1939 | 5,200- 6,500 | 15 | 28 | | | 31.0 |
| | | Bai Hassan, 1953 | 4,800- 5,400 | 56 | 84 | | | 34.0 |
| | | Balad, 1983 | 6,000- 7,000 | 4 | 8 | | | 25.0 |
| | | Butmah, 1953 | 3,900 | 1 | 17 | | | 31.0 |
| | | Buzurgan, 1970 | 12,000 | 20 | 22 | | | 24.0 |
| | | East Baghad, 1975 | 6,000- 7,000 | 32 | 79 | | | 23.0 |
| | | Hamrin, 1973 | 2,000 | ... | 14 | | | 30.0 |
| | | Jabal Fauqui, 1974 | 10,000 | 20 | 23 | | | 25.5 |
| | | Jambur, 1954 | 5,500-12,500 | 27 | 50 | | | 38.0 |
| | | Kirkuk, 1927 | 2,800- 4,200 | 71 | 269 | | | 36.0 |
| | | Luhais, 1961 | 8,200 | 12 | 21 | | | 33.0 |
| | | Naft Khaneh, 1909 | 3,500 | 7 | 11 | | | 42.5 |
| | | Nahr Umar, 1949 | 8,200 | 5 | 13 | | | 42.0 |
| | | Qaiyanah, 1929 | 650 | 33 | 50 | | | 16.0 |
| | | Rumaila North, 1958 | 10,300 | 303 | 443 | | | 33.0 |
| | | Rumaila South, 1953 | 10,200 | 133 | 208 | | | 34.0 |
| | | Suffayah, 1978 | 3,900 | 11 | 39 | | | 25.0 |
| | | West Tikrit, 1985 | 8,200 | 2 | 6 | | | 23.0 |
| | | Zubair, 1949 | 10,200 | 56 | 110 | | | 35.0 |
| | | **Total Iraq** | | **820** | **1,511** | **2,897,000** | **21,671,213,000** | |
| **ISRAEL(e)** | **LAPIDOTH** | Heletz-Brur, 1955 | 5,200 | 4 | 18 | 280 | 16,840,000 | 29.2 |
| | | Kochav, 1962 | 5,500 | 6 | 13 | | | 27.9 |
| | **OEIL** | Ashdod, 1976 | 8,400 | 2 | 2 | | | 32.5 |
| | **EMOG** | Gurim, 1984 | 3,280 | ... | ... | | | 17.0 |
| | | **Total Israel** | | **12** | **33** | **280** | **16,840,000** | |
| **ITALY** | **ELF** | ● Rospo Mare, 1975 | 4,600 | 14 | 16 | 20,576 | 24,547,151 | 12.2 |
| | | ● Santa Maria a Mare, 1974 | 7,900 | 8 | 12 | 833 | 17,986,522 | 22.3 |
| | | ● Sarago Mare, 1979 | 5,200 | 5 | 6 | 4,519 | 11,333,805 | 8.1 |
| | **AGIP** | Benevento, 1974 | 6,599 | 1 | 1 | 493 | 325,713 | 9.0 |
| | | Cavone, 1979 | 10,663-18,068 | 13 | 15 | 2,993 | 8,713,259 | 4.0 |
| | | Cela Mare | 10,300 | 12 | 18 | 1,623 | 15,289,898 | ... |
| | | Emilio S., 1971 | 9,215 | ... | 1 | ... | 337,266 | 3.0 |
| | | Gaggiano, 1982 | 13,766 | 2 | 2 | 260 | 455,537 | 7.0 |
| | | Gela, 1956 | 11,280-11,350 | 53 | 68 | 6,995 | 105,404,448 | ... |
| | | Malossa, 1973 | 17,881-21,231 | 5 | 8 | 628 | 26,138,309 | 5.0 |
| | | Narciso, 1985 | 2,650 | ... | 1 | ... | 337,622 | 1.1 |
| | | Nilde, 1977 | 4,545 | 2 | 3 | 240 | 19,716,499 | 8.9 |
| | | Perla, 1976 | 7,850 | 4 | 4 | 404 | 1,921,622 | 3.3 |
| | | Pisticci-S. Cataldo, 1960 | 6,820- 6,880 | 8 | 12 | 1,248 | 8,356,978 | 1.4 |
| | | Prezioso, 1982 | 16,400 | 3 | 3 | 3,004 | 1,342,326 | ... |
| | | Ragusa, 1954 | 5,760 | 37 | 37 | 4,054 | 129,361,392 | 9.5 |
| | | S. Maria Inbaro, 1985 | 6,520 | 3 | 4 | 130 | 360,273 | 5.9 |
| | | V. Fortuna, 1984 | 19,828 | 3 | 4 | 9,929 | 5,263,951 | 6.0 |
| | | Other | ... | 25 | 63 | 1,959 | 21,508,279 | 0.8-55.0 |
| | **MONTEDISON(e)** | ● Vega | ... | ... | ... | 23,112 | 21,635,880 | ... |
| | | **Total Italy** | | **198** | **346** | **83,000** | **420,336,730** | |
| **IVORY COAST** | **SIOP** | ● Belier, 1975 | 6,500- 7,000 | 13 | 18 | 2,112 | 18,391,119 | 34.5 |
| | **PETROCI** | ● Espoir, 1980 | 6,500-11,000 | ... | ... | ... | 31,102,952 | 32.3 |
| | | **Total Ivory Coast** | | **13** | **18** | **2,112** | **49,494,071** | |
| **JAPAN** | **JAPEX** | ● Aga-Oki, 1972 | 7,590 | 7 | 7 | 710 | 3,293,421 | 24.8 |
| | | Higashi-Niigata, 1965 | 4,500- 9,200 | 19 | 29 | 577 | 7,856,914 | 53.9 |
| | | Katakai, 1960 | 3,310-16,300 | 5 | 16 | 498 | 775,384 | 50.0 |
| | | Sarukawa, 1958 | 2,000- 3,200 | 62 | 134 | 1,280 | 18,704,187 | 32.3 |
| | | Yoshii, 1968 | 8,000 | 9 | 25 | 661 | 9,110,857 | 61.8 |
| | | Yurihara, 1976 | 1,310- 7,610 | 10 | 15 | 266 | 494,299 | 43.5 |
| | | Other | ... | 56 | 75 | 321 | 21,199,489 | ... |
| | **IDEMITSU OIL DEVELOPMENT CO. LTD.** | ● Agaoki-Kita, 1982 | 4,950 | 10 | 10 | 2,364 | 6,500,000 | 37.0 |
| | **TEIKOKU** | Hagashi-Kashiwazaki, 1970 | 6,000- 8,900 | 5 | 10 | 495 | 8,292,629 | 62.0 |
| | | Kubiki, 1959 | 1,100- 6,400 | 95 | 134 | 699 | 11,825,071 | 29.7 |
| | | Minami-Aga, 1964 | 7,300- 9,600 | 11 | 35 | 512 | 14,010,670 | 38.5 |
| | | Minami-Nagaoka, 1984 | 13,200-15,100 | 5 | 13 | 542 | 1,098,164 | 55.7 |
| | | Yabase, 1933 | 1,100- 5,800 | 59 | 80 | 394 | 33,359,850 | 33.0 |
| | | Other | ... | 15 | 15 | 121 | 3,340,006 | ... |
| | | **Total Japan** | | **368** | **598** | **9,440** | **139,860,491** | |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **JORDAN** | NRA | Hamzah, 1984 | 9,500 | 4 | 17 | 400 | 57,400 | 30.0 |
| | | **Total Jordan** | | **4** | **17** | **400** | **57,400** | |
| **KUWAIT(e)** | KOC | Burgan, 1938 | 4,800 | 210 | 393 | 1,593,000 | 23,720,053,000 | 30.8 |
| | | Ahmadi, 1952 | 4,800 | 11 | 84 | | | 31.7 |
| | | Magwa, 1951 | 4,800 | 71 | 113 | | | 33.0 |
| | | Raudhatain, 1955 | 8,600 | 41 | 53 | | | 34.4 |
| | | Bahra, 1956 | 8,500 | ... | 2 | | | ... |
| | | Sabriya, 1957 | 8,300 | 9 | 44 | | | 36.3 |
| | | Minagish, 1959 | 10,000 | 1 | 21 | | | 34.4 |
| | | Umm Gudair, 1962 | 9,000 | 20 | 33 | | | 26.9 |
| | | **Total Kuwait** | | **363** | **743** | **1,593,000** | **23,720,053,000** | |
| **LIBYA** | AGIP | Bu Attifel, 1968 | 14,300 | 33 | 40 | 77,464 | 856,523,977 | 1.0 |
| | | Rimal Katib, 1965 | 14,000 | 6 | 7 | 2,335 | 7,405,965 | 5.0 |
| | | • Bouri | 8,700 | 24 | 24 | 7,348 | 4,359,195 | 6.0 |
| | ELF(e) | El Meheiriga | 10,500 | 1 | 2 | 1,042,853 | 16,053,641,115 | 46.0 |
| | LNOC(e) | Arshad, 1966 | 10,100 | | | | | 42.0 |
| | | Jebel, 1962 | 8,100 | | | | | 38.0 |
| | | Majid, 1968 | 9,000- 9,800 | | | | | ... |
| | | Don Mansour Unit | 5,600 | | | | | ... |
| | | Nasser, 1959 | 5,500- 7,600 | | | | | 38.0 |
| | | Lehib-Dor Marada Unit, 1965 | 9,500 | | | | | 50.0 |
| | | Raguba, 1961 | 5,400 | | | | | 43.0 |
| | | Beda, 1959 | 4,000 | | | | | 36.0 |
| | | Bualawn, 1972 | 6,000 | | | | | 40.0 |
| | | Dor, 1967 | 6,400 | | | | | 33.2 |
| | | Kotla, 1963 | 5,500 | | | | | 34.0 |
| | | Sahabi B & D, 1961 | 9,000-10,000 | | | | | 39.0 |
| | | Sarir, 1961 | 9,000 | | | | | 37.2 |
| | | Amal, 1959 | 9,900 | | | | | 37.5 |
| | | Ora, 1962 | 7,250 | | | | | 40.2 |
| | | Ghani, 1978 | 6,000 | | | | | 40.0 |
| | | Bahi, 1968 | 3,500- 3,750 | | | | | 43.4 |
| | | Belhedan, 1962 | 7,000 | | | | | 33.6 |
| | | Dahra, 1959 | 3,100- 3,700 | | | | | 37.0-41.0 |
| | | Defa, 1969 | 5,400- 5,900 | | | | | 35.6 |
| | | Gialo, 1961 | 2,200- 6,300 | | | | | 35.7 |
| | | Harsh, 1978 | 7,400 | 491 | 491 | | | 34.6 |
| | | Khalifa, 1978 | 5,400- 7,000 | | | | | 34.6 |
| | | Masrab, 1978 | 10,000 | | | | | 39.6 |
| | | Samah, 1961 | 9,000 | | | | | 33.4 |
| | | Waha, 1960 | 6,000 | | | | | 36.0 |
| | | Zaggut, 1962 | 6,000 | | | | | 36.4 |
| | | Balat, 1983 | 5,100- 5,400 | | | | | 32.2 |
| | | Ali, 1975 | 3,900 | 1 | 2 | | | 50.0 |
| | | Almas, 1975 | 4,000 | 5 | 8 | | | 49.5 |
| | | Intisar A, 1967 | 9,750 | 8 | 19 | | | 45.0 |
| | | Intisar B, 1974 | 9,600 | 2 | 2 | | | 50.0 |
| | | Intisar C, 1967 | 9,650 | 1 | 6 | | | 37.5 |
| | | Intisar D, 1967 | 9,400 | 19 | 27 | | | 39.0 |
| | | Intisar E, 1968 | 5,300- 7,100 | 8 | 11 | | | 34.7 |
| | | Nafoora-Augila, 1966 | 2,200-10,000 | 13 | 55 | | | 35.5 |
| | | Aswad, 1978 | 6,250 | 8 | 8 | | | 46.0 |
| | | Sabah, 1977 | 5,500 | 36 | 38 | | | 42.0 |
| | | Zella, 1977 | 6,750 | 27 | 31 | | | 48.1 |
| | | Other | 7,900- 8,900 | 1 | 2 | | | 40.4 |
| | | Fidaa, 1979 | 7,000 | 9 | 9 | | | 41.7 |
| | | Hakim, 1978 | 6,700 | 3 | 3 | | | 48.5 |
| | | **Total Libya** | | **696** | **783** | **1,130,000** | **16,921,930,252** | |
| **MALAYSIA** | ESSO MALAYSIA | • Bekok, 1976 | 5,500 | 22 | 33 | 315,000 | 820,000,000 | 47.0 |
| | | • Guntong, 1978 | 5,200 | 56 | 91 | | | 44.0 |
| | | • Irong Barat, 1979 | 3,300 | 9 | 18 | | | 35.0 |
| | | • Kepong, 1979 | 6,000 | ... | 11 | | | 47.0 |
| | | • Palas, 1979 | 6,300 | 13 | 18 | | | 49.0 |
| | | • Pulai, 1973 | 4,300 | 22 | 32 | | | 42.3 |
| | | • Seligi, 1971 | 4,300 | 16 | 22 | | | 50.0 |
| | | • Semangkok, 1980 | 3,700 | 31 | 41 | | | 42.5 |
| | | • Tabu, 1978 | 5,600 | 15 | 24 | | | 44.0 |
| | | • Tapis, 1975 | 6,700 | 41 | 80 | | | 45.0 |
| | | • Tinggi, 1980 | 4,400 | 21 | 27 | | | 48.0 |
| | | • Tiong, 1978 | 5,800 | 20 | 41 | | | 47.0 |
| | SARAWAK SHELL BERHAD | • D-18, 1981 | 4,000 | 5 | 5 | 3,550 | 2,899,000 | 39.9 |
| | | • Bayan, 1976 | 4,200 | 7 | 9 | 13,110 | 26,498,000 | 37.3 |
| | | • Temana, 1972 | 3,100 | 19 | 29 | 9,560 | 40,199,000 | 35.0 |
| | | • Other | 5.600-11,000 | 29 | 33 | 10,930 | 268,726,000 | ... |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | SABAH SHELL | • Barton, 1971 | 2,400 | 4 | 4 | 3,010 | 10,402,000 | 37.0 |
| | | • Erb West, 1977 | 6,785 | 15 | 19 | 6,630 | 21,620,000 | 30.0 |
| | | • Ketam, 1977 | 4,800 | 1 | 4 | 270 | 999,000 | 30.0 |
| | | • Samarang, 1972 | 5,700 | 56 | 80 | 59,840 | 257,301,000 | 37.0 |
| | | • South Furious, 1974 | 3,300 | 7 | 15 | 3,010 | 13,499,000 | 30.0 |
| | | • St. Joseph, 1975 | 2,200 | 11 | 14 | 16,360 | 20,271,000 | 32.0 |
| | PETRONAS CARIGALI(•) | • Tembungo, 1971 | 6,000 | 8 | 16 | | | 40.0 |
| | SARAWAK SHELL/PETRONAS CAG.(•) | • Bakau | ... | ... | ... | | | ... |
| | | • Baram | ... | ... | ... | | | ... |
| | | • Baronia, 1967 | 7,900 | 19 | 40 | | | 42.0 |
| | | • Betty, 1967 | 7,900 | 13 | 17 | | | 36.0 |
| | | • Bokor, 1972 | 2,000 | 18 | 19 | 125,730 | 577,182,000 | 35.0 |
| | | • Fairley Baram, 1973 | 8,655 | ... | 2 | | | 39.5 |
| | | • Siwa, 1973 | 4,100 | 4 | 4 | | | 25.0 |
| | | • Tukau, 1966 | 5,000 | 26 | 48 | | | 29.2 |
| | | • West Lutong | ... | ... | ... | | | 39.5 |
| | | **Total Malaysia** | | **508** | **796** | **567,000** | **1,990,000,000** | |
| **MEXICO** | NORTH ZONE, NE | Misión, 1945 | 5,440 | | | | | ... |
| | | Monterrey, 1950 | 6,510 | | | | | ... |
| | | Tigrillo, 1971 | 3,342 | | | | | ... |
| | NORTH ZONE, N. | • Arenque, 1970 | 11,362 | | | | | 26.0 |
| | | Constituciones, 1956 | 6,350 | | | | | 17.0 |
| | | Ebano-Pánuco, 1901 | 1,450 | | | | | 12.0 |
| | | Tamaulipas | 4,200 | | | 41,200 | | 19.0 |
| | NORTH ZONE, S. | Chicontepec, 1973 | 4,264 | | | | | 34.1 |
| | | • Isla de Lobos, 1963 | 6,875 | | | | | 40.0 |
| | | • Marsopa, 1974 | 10,198 | | | | | 39.0 |
| | | Naranjos-C. Azul, 1909 | 1,800 | | | | | 22.0 |
| | | Tres Hermanos, 1959 | 6,960 | | | | | 21.0 |
| | | Other | ... | | | | | ... |
| | CENTRAL ZONE, POZA RICA | • Atún, 1966 | 9,040 | | | | | 37.0 |
| | | • Bagre, 1973 | 10,919 | | | | | 33.0 |
| | | Escolín, 1942 | 7,216 | | | | | 26.3 |
| | | Hallazgo, 1955 | 10,170 | | | | | 25.0 |
| | | Jiliapa, 1958 | 7,390 | | | | | 24.0 |
| | | Mecatepec, 1941 | 7,544 | | | | | 29.8 |
| | | Miquetla, 1959 | 6,480 | | | | | 35.0 |
| | | Poza Rica, 1930 | 7,090 | | | | | 35.0 |
| | | Pres. Alemán, 1949 | 8,036 | | | | | 26.0 |
| | | Remolino, 1962 | 10,745 | | | 57,700 | | 29.5 |
| | | San Andrés, 1956 | 10,410 | | | | | 29.0 |
| | | Other | ... | | | | | ... |
| | CENTRAL ZONE, CUENCA DEL PAPALOAPAN | Matapionche, 1974 | 11,129 | | | | | 35.6 |
| | | Other | ... | | | | | ... |
| | CENTRAL ZONE, N. FAJA DE ORO | Acuatempa, 1955 | 4,085 | | | | | 21.0 |
| | | Muro, 1965 | 3,966 | | | | | 17.0 |
| | | Ordónez, 1952 | 5,220 | | | | | 21.0 |
| | | Ocotepec, 1953 | 3,737 | | | | | 20.0 |
| | | Santa Agueda, 1953 | 4,780 | | | | | 16.0 |
| | | Other | ... | | | | | ... |
| | SOUTHERN ZONE, NANCHITAL | Ixhuatlán Ote., 1965 | 1,960 | | | | | 22.6 |
| | | Moloacán, 1962 | 500 | | | | | 22.3 |
| | | Santa Rosa, 1952 | 1,312 | | | | | 25.4 |
| | SOUTHERN ZONE, EL PLAN | Agata, 1956 | 3.830 | | | | | ... |
| | | Bacal, 1976 | 3,500 | | | | | 35.0 |
| | | Concepción, 1974 | 1,600 | | | | | 31.0 |
| | | Cuichapa, 1935 | 2,200 | | | | | 30.0 |
| | | El Plan, 1931 | 1,700 | | | | | 30.0 |
| | | Lacamango, 1973 | 1,700 | | | | | 26.3 |
| | | Los Soldados, 1953 | 4,492 | | | | | 32.0 |
| | | Other | ... | | | | | ... |
| | SOUTHERN ZONE, AGUA DULCE | Blasillo, 1967 | 7,216 | | | 65,400 | | 40.0 |
| | | Cinco Presidentes, 1960 | 6,862 | | | | | 35.0 |
| | | Burro, 1931 | 2,200 | | | | | 26.0 |
| | | Venta, 1954 | 4,730 | | | | | 41.0 |
| | | Ogarrio, 1957 | 5,790 | | | | | 38.0 |
| | | Otates, 1965 | 7,469 | | | | | 39.0 |
| | | Rodador, 1971 | 11,398 | | | | | 26.0 |
| | | Sánchez Magallanes, 1957 | 4,240 | | | | | 27.0 |
| | | San Ramón, 1967 | 9,517 | 4,740 | 4,740 | | 16,547,594,500 | 30.0 |
| | | Tonalá, 1928 | 1,770 | | | | | 28.0 |
| | | Other | ... | | | | | ... |
| | SOUTHEAST ZONE, COMALCALCO | Agave, 1977 | 13,450 | | | | | 41.7 |
| | | Arroyo Zanapa, 1978 | 14,599 | | | | | 38.9 |
| | | Arteza, 1977 | 11,800 | | | | | 26.4 |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Ayapa, 1972 | 8,200 | | | 607,200 | | 7.2 |
| | | Cacho López, 1977 | 14,250 | | | | | 29.0 |
| | | Cáctus, 1972 | 14,100 | | | | | 31.5 |
| | | Carrizo, 1962 | 3,500 | | | | | 23.3 |
| | | Castarrical, 1967 | 10,080 | | | | | 29.3 |
| | | Comoapa, 1979 | 14,432 | | | | | 44.5 |
| | | Copano, 1977 | 11,890 | | | | | 43.9 |
| | | Cunduacán, 1974 | 13,775 | | | | | 28.9 |
| | | El Golpe, 1963 | 3,500 | | | | | 25.7 |
| | | Giraldas, 1977 | 15,225 | | | | | 37.0 |
| | | Iride, 1974 | 13,775 | | | | | 28.5 |
| | | Muspac, 1982 | 9,676 | | | | | 57.0 |
| | | Mecoacán, 1957 | 2,200 | | | | | 8.6 |
| | | Mora, 1981 | ... | | | | | 38.1 |
| | | Mundo Nuevo, 1977 | 11,800 | | | | | 46.0 |
| | | Níspero, 1974 | 14,100 | | | | | 34.4 |
| | | Paredón, 1978 | 15,690 | | | | | 39.8 |
| | | Oxiacaque | 11,150 | | | | | 29.1 |
| | | Platanal, 1978 | 15,900 | | | | | 30.2 |
| | | Río Nuevo, 1975 | 14,950 | | | | | 34.8 |
| | | Samaria (Cret), 1973 | 14,209 | | | | | 31.0 |
| | | Santuario, 1966 | 9,617 | | | | | 37.0 |
| | | Sitio Grande, 1972 | 13,766 | | | | | 35.0 |
| | | Sunuapa, 1978 | 12,887 | | | | | 32.8 |
| | | Tapijualpa, 1982 | 15,613 | | | | | 39.8 |
| | | Tintal, 1968 | 5,904 | | | | | 22.0 |
| | | Topén, 1978 | 11,172 | | | | | 25.4 |
| | | Tupilco, 1959 | 9,685 | | | | | 27.0 |
| | | Bellota, 1982 | 17,056 | | | | | 41.0 |
| | | Cardenas, 1979 | 17,548 | | | | | 38.0 |
| | | Chiapas, 1979 | 12,136 | | | | | 42.0 |
| | | Fenix, 1979 | 17,876 | | | | | 40.0 |
| | | Iris, 1979 | 14,432 | | | | | 39.2 |
| | | Jujo, 1980 | 17,548 | | | | | 32.0 |
| | | Caparroso, 1982 | 18,368 | | | | | 41.2 |
| | | Tecominoacan, 1983 | 19,519 | | | | | 37.5 |
| | | Jolote, 1983 | 18,119 | | | | | 39.4 |
| | | Artesa Terc., 1984 | ... | | | | | 28.0 |
| | | Carmito, 1980 | 10,050 | | | | | 45.6 |
| | | Edén, 1983 | 17,590 | | | | | 38.5 |
| | | Samaria Terc., 1965 | 4,920 | | | | | 13.9 |
| | MARINE ZONE GULF OF CAMPECHE | • Cantarell, 1976 | 8,528 | | | 1,741,800 | | 21.3 |
| | | • Abkatun, 1978 | 11,800 | | | | | 30.0 |
| | | • Ku, 1979 | 10,000 | | | | | 22.0 |
| | | • Pol, 1979 | 12,600 | | | | | 35.0 |
| | | • Chuc, 1982 | 13,100 | | | | | 35.0 |
| | | • Ixtoc, 1984 | ... | | | | | 35.0 |
| | | **Total México** | | **4,740** | **4,740** | **2,513,300** | **16,547,594,500** | |
| **MOROCCO(e)** | | Essaouira | ... | 4 | 4 | 270 | 16,365,350 | ... |
| | | Rharb, 1951 | 4,590 | 1 | 1 | | | ... |
| | | **Total Morocco** | | **5** | **5** | **270** | **16,365,350** | |
| **MYANMAR(e)** | MYANMA | Chauk-Lanywa, 1902 | 1,500- 4,000 | 450 | 450 | 12,000 | 499,555,000 | 36.0 |
| | | Mann, 1970 | 1,600- 7,000 | | | | | 37.5 |
| | | Myanaung, 1964 | 2,000- 4,000 | | | | | 40.5 |
| | | Prome, 1965 | 850- 5,000 | | | | | 36.0 |
| | | Yenangyaung, 1902 | 100- 6,700 | | | | | 36.0 |
| | | **Total Myanmar** | | **450** | **450** | **12,000** | **499,555,000** | |
| **NETHERLANDS** | UNOCAL | • Haven, 1980 | 5,300 | 2 | 2 | 2,746 | 167,484 | 25.5 |
| | | • Helder, 1980 | 4,800 | 11 | 13 | 5,778 | 21,637,264 | 21.6 |
| | | • Helm, 1979 | 4,400 | 9 | 9 | 1,692 | 8,245,485 | 17.9 |
| | | • Hoorn, 1981 | 5,000 | 7 | 8 | 4,564 | 20,943,359 | 25.8 |
| | NAM | Berkel, 1954 | ... | 17 | 17 | 2,417 | 6,720,000 | 32.1 |
| | | DeLier, 1955 | 5,200 | 22 | 33 | 472 | 17,120,000 | 33.2 |
| | | Ijsselmonde, 1956 | ... | 59 | 86 | 4,468 | 92,418,000 | 26.8 |
| | | Pernis West, 1987 | ... | ... | ... | ... | 38,000 | 28.2 |
| | | Plinacker, 1955 | ... | 4 | 5 | 421 | 6,340,000 | 36.3 |
| | | Rotterdam, 1984 | ... | 2 | 2 | 3,946 | 3,719,000 | 30.5 |
| | | Schoonebeek, 1944 | 2,500 | ... | 495 | ... | 238,327,000 | 12.3 |
| | | Wassenaar, 1956 | 4,200 | ... | 41 | ... | 46,977,000 | 18.7 |
| | | Werkendam, 1956 | ... | ... | ... | ... | 252,000 | 33.0 |
| | | Zoetermeer, 1957 | 3,200 | 30 | 30 | 795 | 10,332,000 | 16.5 |
| | CONOCO | • Kotter, 1980 | 6,500 | 8 | 11 | 15,729 | 37,215,459 | 33.0 |
| | | • Logger, 1982 | 6,500 | 6 | 9 | 9,913 | 16,012,118 | 33.5 |
| | AMOCO | • Rijn, 1982 | 6,600 | 12 | 25 | 7,077 | 17,198,048 | 35.0 |
| | | **Total Netherlands** | | **188** | **786** | **60,018** | **543,862,217** | |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **NEUTRAL ZONE** | **AOC** | • Hout, 1969 | 5,300-10,500 | 21 | 34 | 32,881 | 292,130,916 | 33.0 |
| | | • Khafji, 1961 | 4,400-10,300 | 136 | 165 | 232,777 | 2,526,521,038 | 28.2 |
| | **TEXACO & KOC[a]** | S. Fuwaris, 1963 | 6,300 | 5 | 9 | 131,342 | 1,783,940,000 | 25.0 |
| | | S. Umm Gudair, 1966 | 8,900 | 16 | 17 | | | 24.5 |
| | | Wafra, 1953 | 1,100- 7,000 | 322 | 427 | | | 18.9-23.5 |
| | | **Total Neutral Zone** | | **500** | **652** | **397,000** | **4,602,591,954** | |
| **NEW ZEALAND** | **SHELL-BP-TODD** | • Kapuni, 1959 | 11,700 | 11 | 14 | 6,100 | 41,520,000 | 54.0 |
| | | • Maui, 1969 | 11,000 | 14 | 14 | 15,000 | 34,200,000 | 51.0 |
| | **PCNZ** | Ahuroa, 1987 | 8,688 | ... | 1 | ... | 9,800 | 46.1 |
| | | Kaimiro, 1982 | 11,900 | 2 | 2 | 74 | 145,000 | 42.0 |
| | | McKee, 1980 | 7,848- 8,251 | 19 | 22 | 11,000 | 17,680,000 | 38.5 |
| | | Tariki, 1986 | 9,065 | ... | 1 | ... | 1,500 | 52.7 |
| | | Waihapa, 1988 | 10,125-10,643 | 5 | 6 | 6,100 | 3,300,000 | 36.6 |
| | | **Total New Zealand** | | **51** | **60** | **38,274** | **96,856,300** | |
| **NIGERIA** | **AGIP** | Agwe, 1975 | 10,800 | 1 | 1 | 110 | 2,042,504 | 47.9 |
| | | Akri, 1967 | 9,600-10,600 | 3 | 11 | 1,862 | 60,056,817 | 40.1 |
| | | Akri West, 1972 | 9,900-10,200 | ... | 2 | ... | 482,258 | 31.4 |
| | | Asnaka, 1968 | 9,700-12,000 | 1 | 1 | 1,145 | 2,762,447 | 38.4 |
| | | • Beniboye N., 1978 | 9,000-10,000 | 9 | 9 | 8,904 | 11,572,397 | 29.6 |
| | | Beniku, 1974 | 12,000 | ... | 2 | ... | 3,309,326 | 29.5 |
| | | Clough Creek, 1977 | 10,000-12,400 | 7 | 9 | 7,439 | 22,460,507 | 29.3 |
| | | Ebegoro, 1976 | 11,500-12,000 | 7 | 9 | 7,509 | 62,109,913 | 35.7 |
| | | Ebocha, 1965 | 8,000-10,900 | 8 | 16 | 6,959 | 110,337,245 | 35.5 |
| | | Idu, 1973 | 7,750-10,700 | ... | 10 | ... | 13,862,581 | 28.0 |
| | | Kwale, 1967 | 10,000-11,500 | 8 | 10 | 7,667 | 7,500,675 | 36.4 |
| | | M'Bede, 1966 | 7,300- 9,400 | 10 | 20 | 14,132 | 163,238,542 | 40.9 |
| | | Obama, 1973 | 11,600-14,300 | 6 | 8 | 14,577 | 97,780,167 | 37.2 |
| | | Obiafu, 1967 | 9,300-12,200 | 18 | 20 | 15,815 | 85,766,070 | 42.4 |
| | | Obrikom, 1973 | 8,000-10,000 | 6 | 13 | 3,371 | 55,040,901 | 45.1 |
| | | Odugri, 1972 | 12,500 | 2 | 2 | 634 | 9,788,065 | 47.2 |
| | | Ogbogene, 1972 | 10,000 | ... | 2 | ... | 3,302,763 | 73.0 |
| | | Ogbogene W., 1982 | 13,000 | ... | 1 | ... | 353,196 | 56.2 |
| | | Okpai, 1968 | 10,000-12,000 | 8 | 8 | 4,779 | 19,031,162 | 44.6 |
| | | Omoku W., 1975 | 11,500 | ... | 1 | ... | 4,746,492 | 27.4 |
| | | Oshi, 1972 | 9,600-11,300 | 10 | 11 | 9,890 | 66,552,033 | 34.1 |
| | | Taylor Creek, 1975 | 14,100 | 1 | 1 | 469 | 473,058 | 37.7 |
| | | Tebidaba, 1975 | 10,300-13,300 | 7 | 10 | 17,017 | 118,463,094 | 33.0 |
| | | Umuoru, 1975 | 14,100 | 3 | 4 | 2,477 | 5,353,184 | 40.0 |
| | **ASHLAND** | • Adanga, 1980 | 10,611-17,586 | 9 | 9 | 12,953 | 15,386,228 | 35.0 |
| | | • Akam, 1980 | 6,700 | 10 | 10 | 7,561 | 5,802,362 | 35.2 |
| | | • Bogi, 1989 | 8,256 | 3 | 4 | 1,466 | 563,367 | 23.4 |
| | | • Ebughu, 1983 | 7,250 | 3 | 3 | 457 | 167,263 | 21.0 |
| | | • Izombe-Ossu, 1974 | 9,500 | 8 | 8 | 13,262 | 10,645,430 | 35.0 |
| | | • Mimbo, 1989 | 7,973 | 4 | 5 | 1,967 | 554,146 | 36.0 |
| | | • Ukpam, 1989 | 7,425 | 1 | 2 | 2,474 | 945,474 | 40.9 |
| | **ELF** | Aghigo, 1972 | 7,303 | 17 | 29 | 4,446 | 24,405,554 | 24.8 |
| | | Erema, 1972 | 11,211 | 4 | 5 | 4,715 | 10,847,810 | 24.6 |
| | | Obagi, 1964 | 8,377 | 61 | 68 | 48,743 | 368,074,953 | 24.6 |
| | | Obodo-Jatumi, 1966 | ... | 16 | 18 | 16,116 | 69,115,408 | 24.8 |
| | | Okpoko, 1967 | 6,745 | 16 | 17 | 7,304 | 32,326,957 | 24.8 |
| | | Upomani, 1965 | 6,256 | 14 | 14 | 3,600 | 16,898,167 | 24.8 |
| | **GULF NIGERIA** | Abiteye, 1970 | 5,750- 9,400 | 10 | 19 | 5,294 | 64,007,793 | 39.7 |
| | | • Delta, 1965 | 5,600- 9,500 | 20 | 27 | 18,566 | 169,822,039 | 37.3 |
| | | • Delta South, 1965 | 7,100-10,179 | 18 | 28 | 31,483 | 269,735,952 | 38.4 |
| | | • Isan, 1970 | 5,900- 9,000 | 6 | 11 | 2,369 | 42,897,085 | 40.4 |
| | | Jisike, 1975 | 6,300- 7,600 | 1 | 4 | 1,589 | 6,338,968 | 41.1 |
| | | Makaraba | 7,100-12,005 | 20 | 25 | 20,819 | 92,637,107 | 27.7 |
| | | • Malu, 1969 | 4,800- 6,300 | 12 | 19 | 16,371 | 102,394,051 | 40.4 |
| | | • Mefa, 1965 | 8,570-12,030 | 5 | 5 | 5,832 | 67,968,348 | 38.1 |
| | | • Meji, 1965 | 5,200-10,900 | 19 | 22 | 18,979 | 151,312,520 | 31.9 |
| | | • Meren, 1965 | 5,000- 7,500 | 31 | 55 | 57,685 | 493,040,316 | 31.9 |
| | | • Mina | ... | 3 | 3 | 6,161 | 2,248,843 | 40.3 |
| | | • Okan, 1964 | 5,500- 9,245 | 35 | 71 | 33,485 | 390,246,940 | 38.1 |
| | | • Parabe/Eko, 1968 | 4,500- 8,200 | 13 | 26 | 10,783 | 103,215,846 | 40.4 |
| | | Robertkiri, 1964 | 11,484-13,190 | 10 | 12 | 10,403 | 12,516,783 | 40.2 |
| | | • Tapa, 1978 | 8,150-10,842 | 8 | 10 | 9,233 | 28,142,426 | 39.5 |
| | | Utonana, 1971 | 7,400- 9,165 | 1 | 5 | 816 | 8,165,121 | 20.4 |
| | | • W. Isan, 1971 | 7,825-10,229 | 5 | 9 | 2,011 | 34,745,318 | 40.4 |
| | | Yorla South, 1974 | 11,389-12,635 | ... | 2 | ... | 834,040 | 41.0 |
| | **MOBIL** | • Adua, 1967 | 6,970 | 5 | 5 | 10,768 | 46,537,232 | 30.3 |
| | | • Asabo, 1966 | 5,600 | 9 | 14 | 15,175 | 161,113,170 | 32.4 |
| | | • Asabo D | ... | 1 | 2 | 1,241 | 2,250,081 | 36.0 |
| | | • Ata | ... | ... | ... | ... | 433 | ... |
| | | Edop | 8,528- 9,901 | 3 | 4 | 21,558 | 8,394,906 | 37.7 |
| | | • Ekpe, 1966 | 8,200 | 8 | 17 | 9,613 | 188,394,905 | 30.3 |
| | | • Ekpe-WW, 1977 | 6,810 | 5 | 6 | 7,449 | 190,3325,525 | 30.3 |

| | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|
| | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | • Eku, 1966 | 5,420 | 3 | 7 | 3,178 | 15,955,736 | 30.8 |
| | • Enang, 1968 | 6,600 | 18 | 23 | 23,127 | 35,960,995 | 35.1 |
| | • Etim, 1968 | 6,200 | 7 | 9 | 16,989 | 112,511,703 | 32.9 |
| | • Idoho, 1966 | 9,020 | 3 | 4 | 1,017 | 28,842,611 | 30.8 |
| | • Inim, 1966 | 5,850 | 7 | 10 | 14,963 | 145,437,397 | 37.8 |
| | • Isobo, 1968 | 7,345 | 3 | 5 | 3,263 | 8,180,634 | 30.8 |
| | • Iyak SE | 7,441 | 6 | 5 | 16,155 | 40,682,165 | 38.7 |
| | • Mfem, 1967 | 5,200 | 2 | 4 | 4,185 | 25,627,206 | 36.1 |
| | • Oso | ... | ... | ... | ... | ... | ... |
| | • Ubit, 1968 | 5,400 | 30 | 45 | 25,322 | 185,674,618 | 36.1 |
| | • Unam, 1968 | 5,180 | 7 | 8 | 9,744 | 43,881,190 | 33.5 |
| | • Usari | ... | ... | ... | ... | 5,885 | ... |
| | • Utue, 1966 | 5,700 | 5 | 7 | 8,653 | 70,170,645 | 36.8 |
| **PAN OCEAN (NIGERIA)** | Ogharete, 1973 | 9,900 | 7 | 7 | 2,764 | 9,890,444 | 47.4 |
| **SHELL** | Abura | ... | 1 | 3 | ... | 17,247,935 | 44.6 |
| | Afremo | ... | 9 | 9 | 18,982 | 12,036,226 | 36.9 |
| | Ahia | ... | 8 | 13 | 4,171 | 86,874,306 | 39.4 |
| | Akaso | | ... | 1 | ... | ... | ... |
| | Akpor | ... | ... | 3 | ... | ... | 27.5 |
| | Alakiri | 9,625-10,712 | 12 | 21 | 7,248 | 88,233,759 | 44.7 |
| | Amukpe | ... | 2 | 2 | 1,853 | 13,154,765 | 41.1 |
| | Assa | ... | 2 | 2 | 1,051 | 5,562,686 | 20.16 |
| | Bugama Creek | ... | 5 | 7 | 1,366 | 13,312,766 | 36.8 |
| | Cesw-Adibawa, 1967 | 11,950 | 12 | 23 | 16,383 | 82,548,600 | 26.2 |
| | Cesw-Adibawa NE, 1973 | ... | 3 | 3 | 6,175 | 17,107,947 | 27.5 |
| | Cesw-Diebu Creek, 1966 | 13,119 | 4 | 8 | 10,620 | 108,910,459 | 40.8 |
| | Cesw-Etelebou, 1971 | 12,000 | 9 | 9 | 15,746 | 126,903,233 | 31.0 |
| | Cesw-Kolo Creek, 1960 | 12,000 | 15 | 25 | 20,023 | 136,712,922 | 39.4 |
| | Cesw-Nun River, 1960 | 14,200 | 4 | 6 | 2,098 | 32,772,212 | 33.7 |
| | Cesw-Ubie, 1961 | 14,380 | 5 | 6 | 4,755 | 33,017,108 | 26.7 |
| | Cosw-Nembe Creek, 1973 | 12,213 | 35 | 38 | 66,744 | 249,866,511 | 30.6 |
| | Eade-Opobo South, 1974 | ... | 4 | 6 | 4,109 | 20,268,510 | 43.1 |
| | Eade-Utapate South, 1974 | ... | 6 | 8 | 6,418 | 39,304,491 | 39.0 |
| | Ebubu | ... | 2 | 8 | 157 | 18,808,065 | 19.8 |
| | Egb-Oguta, 1965 | 10,300 | 8 | 11 | 6,346 | 132,487,741 | 43.9 |
| | Egbema | ... | 6 | 7 | 4,306 | 55,381,361 | 34.8 |
| | Egbema West | ... | 5 | 7 | 4,622 | 81,832,450 | 41.1 |
| | Enwhe | ... | ... | 2 | ... | ... | ... |
| | Forc-Ajuju, 1970 | 13,324 | 1 | 2 | ... | ... | 27.0 |
| | Forc-Batan, 1968 | 11,000 | 7 | 3 | 6,285 | 57,482,932 | 21.3 |
| | Forc-Benisede, 1973 | ... | 11 | 14 | 31,089 | 114,511,463 | 22.0 |
| | Forc-Egwa, 1967 | 9,350 | 17 | 19 | 18,337 | 140,603,754 | 33.4 |
| | Forc-Escravos Beach, 1969 | 8,176 | 7 | 8 | 10,140 | 61,920,984 | 30.4 |
| | Forc-Forcados/Yokri, 1968 | 10,859 | 51 | 52 | 69,810 | 571,116,961 | 24.4 |
| | Forc-Jones Creek, 1967 | 7,000- 9,000 | 24 | 26 | 44,199 | 410,217,843 | 29.8 |
| | Forc-Odidi, 1967 | 10,980 | 25 | 28 | 43,942 | 222,326,504 | 36.4 |
| | Forc-Opuama, 1973 | ... | 2 | 2 | 2,734 | 26,496,113 | 42.4 |
| | Forc-Opukushi, 1963 | 7,823 | 9 | 10 | 26,104 | 124,368,680 | 28.4 |
| | Forc-Opukushi N., 1977 | ... | 1 | 2 | 556 | 2,791,314 | 24.7 |
| | Forc-Otumara, 1969 | 8,176 | 21 | 25 | 41,532 | 171,485,364 | 24.9 |
| | Forc-Saghara, 1970 | 8,590 | 5 | 6 | 7,858 | 34,812,316 | 31.9 |
| | Ibigwe | ... | 1 | 2 | ... | ... | ... |
| | Kalaekule | ... | 6 | 7 | 13,090 | 8,932,181 | 40.3 |
| | Korokoro | ... | 6 | 8 | 2,703 | 84,303,645 | 36.0 |
| | Krakama | ... | 3 | 10 | 1,682 | 18,049,647 | 22.8 |
| | Node-Oben, 1972 | 12,036 | 14 | 23 | 19,935 | 128,437,854 | 37.5 |
| | Node-Sapele, 1970 | 12,788 | 10 | 11 | 13,982 | 118,226,990 | 43.1 |
| | Obele | ... | ... | 5 | ... | ... | ... |
| | Odeama Creek | ... | 4 | 5 | 20,847 | 28,171,077 | 35.4 |
| | Osioka | ... | 1 | 2 | 786 | 7,502,989 | 26.2 |
| | Otamini | ... | 2 | 2 | 1,649 | 14,564,408 | 20.8 |
| | Phl-Afam, 1956 | 6,000 | 9 | 9 | 2,240 | 60,521,763 | 45.2 |
| | Phl-Agbada, 1960 | 8,000-12,000 | 30 | 31 | 20,718 | 188,963,520 | 24.4 |
| | Phl-Ajokpori, 1967 | ... | 1 | 2 | 453 | 5,654,946 | 39.0 |
| | Phl-Akuba, 1967 | ... | 1 | 1 | 402 | 4,392,385 | 22.7 |
| | Phl-Apara, 1960 | 9,000 | 4 | 4 | 4,935 | 27,913,330 | 38.3 |
| | Phl-Bodo-West, 1959 | 9,700 | 9 | 9 | 4,919 | 82,443,920 | 26.5 |
| | Phl-Bomu, 1958 | 6,500- 7,500 | 9 | 11 | 7,574 | 357,197,222 | 36.8 |
| | Phl-Elelenwa, 1959 | 11,000 | 5 | 6 | 3,684 | 33,750,837 | 35.3 |
| | Phl-Imo River, 1959 | 5,800-10,000 | 37 | 40 | 37,788 | 481,411,176 | 31.0 |
| | Phl-Isimiri, 1964 | 5,900-11,000 | 1 | 3 | 1,617 | 38,226,064 | 26.0 |
| | Phl-Nkali, 1963 | 12,000 | 3 | 3 | 3,848 | 30,539,652 | 39.3 |
| | Phl-Obeakpu, 1975 | ... | 2 | 2 | 3,098 | 18,230,182 | 26.4 |
| | Phl-Obigbo-North, 1963 | 6,500-10,000 | 23 | 23 | 12,329 | 178,774,185 | 23.3 |
| | Phl-Onne, 1965 | 10,384 | 3 | 3 | 1,210 | 9,804,577 | 34.3 |
| | Phl-Umuechem, 1969 | 5,800-10,700 | 8 | 10 | 4,495 | 149,809,342 | 35.6 |
| | Phl-Yorla, 1970 | 11,917 | 4 | 7 | 4,367 | 61,810,385 | 39.6 |
| | Phs-Akaso, 1979 | ... | 1 | 1 | 1,486 | 3,770,294 | 36.6 |
| | Phs-Bonny, 1959 | 12,254 | 8 | 8 | 5,260 | 91,565,141 | 31.8 |
| | Phs-Cawthorne Channel, 1963 | 11,000 | 19 | 21 | 44,904 | 297,078,967 | 38.3 |
| | Phs-Ekulama, 1958 | 10,483 | 20 | 20 | 37,116 | 215,051,740 | 32.0 |
| | Phs-Orubiri, 1971 | ... | 1 | 2 | 2,933 | 18,120,944 | 37.98 |

|  |  |  |  | No. of wells |  | Production |  |  |
|---|---|---|---|---|---|---|---|---|
|  |  | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|  |  | Phs-Soku, 1958 | 11,500 | 17 | 23 | 10,985 | 115,359,210 | 28.0 |
|  |  | Rapele | ... | 1 | 3 | 489 | 23,012,074 | 44.4 |
|  |  | Rumuekpe | ... | 2 | 3 | 2,217 | 1,829,155 | 29.3 |
|  |  | Tai | ... | 1 | 2 | 554 | 4,887,832 | 38.1 |
|  |  | Ugada | ... | 1 | 1 | ... | ... | ... |
|  |  | Ugh-Afiesere, 1966 | 8,000- 9,000 | 23 | 27 | 10,466 | 121,140,585 | 18.9 |
|  |  | Ugh-Eriemu, 1961 | 12,500 | 12 | 14 | 5,480 | 45,696,354 | 20.1 |
|  |  | Ugh-Evwreni, 1968 | 10,900 | 8 | 9 | 3,497 | 37,874,976 | 25.2 |
|  |  | Ugh-Isoko, 1960 | ... | 1 | 2 | 765 | 6,234,074 | 30.3 |
|  |  | Ugh-Kokori, 1960 | 8,000- 9,800 | 7 | 8 | 10,061 | 315,106,094 | 45.2 |
|  |  | Ugh-Ogini, 1964 | 5,860 | 4 | 5 | 2,944 | 23,389,308 | 18.7 |
|  |  | Ugh-Olomoro, 1963 | 7,000-10,000 | 16 | 22 | 15,234 | 286,297,772 | 21.4 |
|  |  | Ugh-Oroni, 1964 | 12,000 | 4 | 5 | 2,031 | 26,716,637 | 22.4 |
|  |  | Ugh-Oweh, 1964 | 12,300 | 9 | 9 | 5,841 | 96,495,512 | 26.2 |
|  |  | Ugh-Ughelli-East, 1959 | 11,800 | 7 | 7 | 2,571 | 90,512,168 | 38.6 |
|  |  | Ugh-Ughelli-West, 1963 | 7,400-10,200 | 7 | 9 | 5,483 | 35,202,936 | 20.4 |
|  |  | Ugh-Utorogu, 1964 | 9,000 | 16 | 16 | 7,246 | 133,198,137 | 28.3 |
|  |  | Ugh-Uzere-East, 1960 | 8,500 | 11 | 11 | 6,497 | 90,364,319 | 33.9 |
|  |  | Ugh-Uzere-West, 1964 | 8,500 | 10 | 10 | 5,723 | 101,566,708 | 24.2 |
|  |  | Ugh-Warri-River, 1961 | 12,264 | 1 | 2 | 795 | 15,366,811 | 29.4 |
|  | **TEXACO-CHEVRON-NNPC** | • Funiwa, 1978 | 5,000- 7,000 | 20 | 22 | 22,177 | 43,904,868 | 38.2 |
|  |  | • Middleton, 1972 | 5,000- 7,000 | 3 | 7 | 2,363 | 15,813,022 | 36.6 |
|  |  | • North Apoi, 1973 | 4,000- 8,100 | 22 | 26 | 33,776 | 162,994,363 | 35.8 |
|  |  | • Pennington, 1965 | 5,000-10,400 | 1 | 10 | 2,000 | 35,109,345 | 38.2 |
|  |  | • Sengana, 1967 | 11,400-12,500 | ... | 2 | ... | 666,120 | 46.7 |
|  | **TENNECO** | Abura | 13,452 | 1 | ... | 1,451 | 17,247,935 | 44.6 |
|  | **AGIP ENERGY** | Agbara, 1968 | 10,699 | 16 | 16 | 9,500 | 2,365,648 | 42.5 |
|  | **DUBRI** | Gili-Gili | ... | 1 | ... | 981 | 8,074,119 | 46.9 |
|  |  | **Total Nigeria** |  | **1,432** | **1,898** | **1,673,809** | **12,752,358,229** |  |
| **NORWAY** | **AMOCO** | • Valhall, 1972 | 8,200 | 22 | 22 | 73,092 | 129,725,993 | 35.0 |
|  | **BP** | • Ula, 1976 | 10,100 | 6 | 13 | 88,037 | 98,724,867 | 36.8 |
|  | **CONOCO** | • Murchison*, 1975 | 9,900 | 18 | 30 | 8,160 | 57,716,337 | 38.0 |
|  | **NORSK HYDRO** | • Oseberg, 1979 | 7,500 | 8 | 12 | 233,003 | 85,046,019 | 34.0 |
|  | **PHILLIPS** | • Albuskjell, 1972 | 10,400 | 13 | 19 | 2,447 | 42,162,601 | 45.0 |
|  |  | • Cod, 1968 | 9,500 | 6 | 8 | 1,191 | 15,659,706 | 55.0 |
|  |  | • Edda, 1972 | 10,480-10,600 | 7 | 7 | 2,948 | 22,722,952 | 41.5 |
|  |  | • Ekofisk, 1968 | 10,000 | 41 | 44 | 112,782 | 931,408,127 | 41.1 |
|  |  | • Eldfisk, 1970 | 9,350-10,000 | 37 | 39 | 76,978 | 262,167,186 | 41.1 |
|  |  | • Tor, 1970 | 10,000 | 12 | 13 | 8,703 | 110,437,189 | 38.0 |
|  |  | • West Ekofisk, 1970 | 10,300 | 9 | 14 | 3,717 | 71,550,961 | 43.9 |
|  | **STATOIL** | • Gullfaks, 1978 | 9,500- 9,700 | 63 | 95 | 267,000 | 181,100,000 | 9.3 |
|  |  | • Statfjord†, 1974 | 9,500 | 59 | 93 | 585,790 | 1,455,195,549 | 38.2 |
|  |  | • Tommeliten, 1976 | 10,400 | 5 | 6 | 13,534 | 4,939,866 | 47.0 |
|  |  | • Veslefrikk, 1981 | 10,100 | 12 | 18 | ... | ... | ... |
|  |  | **Total Norway** |  | **318** | **433** | **1,477,382** | **3,468,557,353** |  |
| **OMAN** | **PDO** | Al Burj, 1987 | 6,890 | 6 | 7 | 850 | 2,288,000 | 28.6 |
|  |  | Al Ghubar, 1974 | 1,916 | 3 | 6 | 5,300 | 6,842,000 | 28.4 |
|  |  | Al Huwaisah, 1969 | 5,320 | 43 | 47 | 16,500 | 177,091,000 | 37.1 |
|  |  | Amal/Amal South, 1973 | 4,638 | 34 | 39 | 11,900 | 15,974,000 | 24.0 |
|  |  | Anzauz, 1984 | 7,098 | 4 | 4 | 4,600 | 8,088,000 | 46.0 |
|  |  | Bahja, 1984 | 5,697 | 10 | 12 | 12,100 | 12,822,000 | 48.9 |
|  |  | Barik, 1974 | 6,856 | 3 | 3 | 2,300 | 3,190,000 | 47.8 |
|  |  | Birba, 1978 | 8,528 | ... | ... | 1,446 | 8,394,000 | 30.5 |
|  |  | Burhaan, 1984 | 4,011 | 2 | 4 | 900 | 1,981,000 | 36.9 |
|  |  | Dhiab, 1985 | 5,414 | 6 | 6 | 900 | 955,000 | 25.7 |
|  |  | Fahud, 1964 | 2,499 | 153 | 235 | 56,000 | 794,423,000 | 32.5 |
|  |  | Fayyadh, 1983 | 3,608 | 1 | 1 | 6,300 | 706,000 | 27.5 |
|  |  | Ghaba North, 1972 | 2,227 | 14 | 25 | 6,000 | 54,850,000 | 34.5 |
|  |  | Habur, 1975 | 5,800 | 1 | 2 | 250 | 4,481,000 | 15.6 |
|  |  | Hasirah, 1984 | 8,708 | 10 | 12 | 9,100 | 7,339,000 | 49.8 |
|  |  | Ishan, 1984 | 5,578 | 5 | 6 | 1,800 | 1,335,000 | 28.6 |
|  |  | Jalmud, 1979 | 4,236 | 3 | 3 | 270 | 467,000 | 22.5 |
|  |  | Jalmud North, 1980 | 4,265 | 2 | 2 | 270 | 351,000 | 22.5 |
|  |  | Jameel, 1984 | 5,906 | 4 | 5 | 1,500 | 1,025,000 | 28.6 |
|  |  | Jawdah, 1984 | 3,570 | 6 | 7 | 1,800 | 2,385,000 | 22.5 |
|  |  | Karim West, 1982 | 3,546 | 26 | 27 | 12,200 | 18,531,000 | 23.1 |
|  |  | Kaukab, 1983 | 8,282 | 1 | 1 | 700 | 1,401,000 | 31.9 |
|  |  | Lekhwair, 1968 | 4,352 | 47 | 63 | 26,200 | 75,262,000 | 38.6 |
|  |  | Mahjour, 1979 | 11,700 | 1 | 3 | 600 | 2,461,000 | 47.5 |
|  |  | Marmul, 1977 | 5,087 | 169 | 185 | 34,100 | 137,075,000 | 22.3 |
|  |  | Mawhoob, 1985 | 6,562 | 1 | 1 | 40 | 95,400 | 28.6 |
|  |  | Mukhaizna, 1975 | 3,478 | ... | ... | ... | 12,400 | 15.0 |
|  |  | Natih, 1963 | 4,788 | 36 | 68 | 24,700 | 360,400,000 | 31.2 |
|  |  | Nimr, 1980 | 3,296 | 117 | 119 | 36,000 | 37,844,000 | 21.3 |

*Norway share (22.2%) of total production. †Norway share (84.09%) of total production.

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Qaharir, 1978 | 4,536 | 27 | 32 | 7,400 | 26,432,000 | 30.4 |
| | | Qaharir East, 1978 | 4,936 | 2 | 4 | 150 | 791,000 | 30.4 |
| | | Qam Alam, 1972 | 1,354 | 4 | 7 | 900 | 19,665,000 | 15.6 |
| | | Qata, 1979 | 4,707 | 11 | 16 | 2,100 | 5,023,000 | 28.6 |
| | | Rahab, 1977 | 3,237 | 21 | 28 | 2,900 | 7,523,000 | 25.7 |
| | | Ramlat Rawl, 1987 | 2,720 | 1 | 1 | 2,500 | 1,039,000 | 39.7 |
| | | Rasha, 1982 | 4,310 | 4 | 5 | 700 | 1,560,000 | 32.9 |
| | | Rima, 1979 | 3,247 | 47 | 48 | 65,500 | 153,293,000 | 32.9 |
| | | Runib, 1978 | 3,215 | 10 | 10 | 2,300 | 2,651,000 | 20.3 |
| | | Saih Nihaydah, 1972 | 8,700 | 21 | 28 | 30,000 | 168,580,000 | 39.4 |
| | | Saih Rawl, 1973 | 9,826 | 14 | 24 | 7,500 | 93,702,000 | 39.7 |
| | | Sayyala, 1981 | 3,690 | 14 | 14 | 22,700 | 38,483,000 | 47.8 |
| | | Shibkah, 1976 | 2,591 | ... | 2 | 40 | 835,000 | 31.2 |
| | | Simsim, 1985 | 5,250 | 11 | 12 | 5,000 | 4,817,000 | 28.1 |
| | | Suwaihat, 1982 | 6,452 | 10 | 10 | 10,600 | 15,640,000 | 41.5 |
| | | Thuleilat, 1986 | 3,773 | 14 | 15 | 3,300 | 3,096,000 | 23.8 |
| | | Wafra, 1983 | 5,510 | 7 | 8 | 5,100 | 3,791,000 | 36.5 |
| | | Warad, 1985 | 4,922 | 5 | 5 | 1,600 | 1,256,000 | 29.3 |
| | | Yibal, 1962 | 8,465 | 194 | 206 | 149,100 | 722,333,000 | 37.9 |
| | | Zahra, 1986 | 6,562 | 5 | 5 | 1,100 | 839,000 | 29.3 |
| | | Zareef, 1985 | 3,264 | 10 | 11 | 12,000 | 10,4[illegible],000 | 47.3 |
| | | Zauliyah, 1981 | 8,177 | 10 | 14 | 5,400 | 14,879,000 | 46.9 |
| | OCCIDENTAL | Safah, 1983 | 6,500 | 81 | 81 | 22,300 | 15,795,000 | 42.0 |
| | ELF GROUP | Ramlat | ... | 1 | 1 | 80 | 148,000 | 46.0 |
| | | Sahmah, 1978 | 12,400 | 8 | 8 | 5,300 | 26,480,000 | 46.0 |
| | | **Total Oman** | | **1,240** | **1,488** | **640,196** | **3,077,124,800** | |
| **PAKISTAN** | PAKISTAN OILFIELD LTD. | Balkassar, 1946 | 9,398 | 4 | 17 | 589 | 31,903,730 | 26.0 |
| | | Dhulian, 1936 | 9,899 | 12 | 49 | 24 | 41,332,384 | 48.0 |
| | | Meyal, 1968 | [illegible],513 | 6 | 6 | 2,913 | 31,923,697 | 41.3 |
| | | Joya Mair, 1944 | 6,900 | 2 | 4 | 411 | 6,069,324 | 15.0 |
| | | Khaur, 1915 | 9,306 | 13 | 397 | 19 | 4,177,167 | 33.0 |
| | PAKISTAN PETROLEUM LTD. | Adhi, 1978 | 9,452- 9,613 | 5 | 5 | 398 | 1,467,721 | 51.0 |
| | OGDC | Bobi, 1988 | 9,515- 7,897 | 3 | 3 | 611 | 223,085 | 52.0 |
| | | Chak-Naurang, 1986 | 9,187 | 3 | 4 | ... | 322,508 | 12.1 |
| | | Fimkassar, 1982 | 11,465 | 1 | 1 | 425 | 190,952 | 29.4 |
| | | Ghotana, 1986 | 7,300 | 1 | 1 | ... | 103,902 | 41.1 |
| | | Lashari Centre, 1988 | 6,916 | 1 | 1 | 1,763 | 682,185 | 44.2 |
| | | Pasahki, 1989 | 7,153 | 1 | 1 | 202 | 77,257 | 43.0 |
| | | Sono, 1988 | 7,618 | 3 | 4 | 1,758 | 1,045,318 | 40.5 |
| | | Tando Alam, 1984 | 6,890- 7,448 | 4 | 10 | 2,472 | 6,429,984 | 41.7 |
| | | Thora, 1987 | 7,546 | 5 | 5 | 4,091 | 2,612,488 | 42.2 |
| | | Toot, 1968 | 15,135 | 5 | 14 | 1,153 | 10,325,565 | 39.0 |
| | UNION TEXAS | Dabhi, 1984 | 5,594 | 2 | 4 | 1,045 | 2,210,000 | 42.0 |
| | | Khaskeli, 1981 | 3,387 | 4 | 11 | 999 | 7,421,232 | 38.0 |
| | | Laghari, 1983 | 2,584 | 4 | 7 | 5,409 | 13,944,754 | 42.0 |
| | | Mazari, 1985 | 3,888 | 5 | 5 | 6,141 | 6,946,062 | 43.0 |
| | | South Mazari, 1985 | 3,920 | 2 | 4 | 2,463 | 899,021 | 43.0 |
| | | Other | ... | 7 | 8 | 549 | 200,230 | 31.0-46.0 |
| | OCCIDENTAL | Bhangali, 1989 | 12,650 | 1 | 1 | 2,240 | 206,040 | 32.5 |
| | | Dhurnal, 1984 | 13,100 | 4 | 6 | 17,169 | 28,573,996 | 38.0 |
| | | **Total Pakistan** | | **98** | **588** | **52,844** | **199,288,602** | |
| **PERU** | PETROMAR S.A. | ● Litoral, 1955 | 1,500- 6,000 | 103 | 134 | 2,205 | 38,155,610 | 36.0-40.0 |
| | | ● Lobitos, 1960 | 3,500- 7,500 | 140 | 268 | 6,672 | 54,791,522 | 38.0 |
| | | ● Pena Negra, 1960 | 3,000- 8,500 | 183 | 304 | 9,876 | 112,559,041 | 38.0 |
| | | ● Providencia, 1967 | 3,000- 7,000 | 47 | 92 | 1,716 | 21,882,501 | 38.0-40.0 |
| | | Other | ... | 4 | 12 | 98 | 291,705 | ... |
| | OCCIDENTAL | Bartra, 1979 | 8,000- 8,930 | 7 | 16 | 2,883 | 19,215,565 | 11.6 |
| | | Capahuari Sur, 1973 | 11,800-12,900 | 14 | 21 | 7,722 | 134,808,739 | 33.7 |
| | | Dorissa, 1978 | 9,800-10,600 | 4 | 13 | 6,175 | 39,421,977 | 32.0 |
| | | Forestal, 1973 | 9,000- 9,900 | 6 | 12 | 4,928 | 36,696,670 | 18.5 |
| | | Huayuri Sur, 1977 | 10,000-10,800 | 5 | 12 | 2,561 | 19,505,497 | 28.5 |
| | | Jibarito, 1981 | 9,000- 9,650 | 4 | 5 | 4,737 | 13,186,861 | 10.5 |
| | | Jibaro, 1974 | 10,110-10,155 | 4 | 6 | 2,306 | 8,330,884 | 10.6 |
| | | San Jacinto, 1978 | 7,200- 9,760 | 11 | 22 | 5,859 | 31,091,167 | 14.9 |
| | | Shiviyacu, 1973 | 9,100-10,100 | 18 | 26 | 17,909 | 71,596,811 | 20.3 |
| | | Other | ... | 3 | 12 | 701 | 2,307,545 | 21.3 |
| | OCCIDENTAL/BRIDAS | Talara area, 1978 | 1,343- 6,080 | 757 | 1,244 | 5,647 | 48,614,022 | 34.8 |
| | PETROPERU | Capirona, 1972 | 9,800-12,000 | 3 | 5 | 556 | 3,742,954 | 25.0 |
| | | Corrientes, 1971 | 10,000-12,600 | 28 | 36 | 19,375 | 101,536,099 | 24.9 |
| | | N. Esperanza, 1980 | 10,200-10,700 | 2 | 3 | 1,920 | 5,570,559 | 42.5 |
| | | Pavayacu, 1972 | 9,600-11,300 | 9 | 14 | 2,665 | 17,458,776 | 29.5 |
| | | Selva Central | ... | 36 | 46 | 2,633 | 27,362,437 | 36.0 |
| | | Talara-Lima area, 1869 | 2,000- 9,000 | 2,142 | 6,117 | 21,789 | 961,984,018 | 32.3 |
| | | Valencia, 1975 | 10,500-11,200 | 1 | 2 | 30 | 546,548 | 43.0 |
| | | Yanayacu, 1974 | 11,400-13,600 | 5 | 9 | 1,080 | 4,505,374 | 18.8 |
| | | **Total Peru** | | **3,536** | **8,431** | **132,043** | **1,775,162,882** | |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **PHILIPPINES** | ALCORN PHILIPPINES | • Galoc, 1981 | 7,260- 7,280 | ... | ... | ... | 383,460 | 37.2 |
| | | • Matinloc, 1978 | 6,656- 6,750 | 3 | 5 | 1,141 | 9,864,707 | 43.8 |
| | | • Nido, 1977 | 6,576- 6,885 | 3 | 5 | 709 | 16,056,500 | 27.1 |
| | | • North Matinloc, 1987 | 6,830- 7,021 | 3 | 3 | 1,652 | 922,917 | 43.2 |
| | ALCORN PALAWAN | • Cadlao, 1977 | 5,734- 5,881 | 2 | 2 | 1,445 | 10,446,633 | 45.6 |
| | TRANS-ASIA OIL & MINERAL DEVELOPMENT CORP. | • South Tara, 1987 | 4,335- 4,436 | 1 | 1 | 198 | 218,251 | 40.4 |
| | | **Total Philippines** | | 12 | 16 | 5,145 | 37,892,468 | |
| **QATAR(e)** | QGPC | • Bul Hanine, 1970 | 6,000 | 14 | 15 | 387,000 | 4,312,876,000 | 35.0 |
| | | Dukhan, 1940 | 6,500 | 116 | 161 | | | 41.1 |
| | | • Idd El Shargi, 1960 | 4,500- 8,250 | 25 | 31 | | | 35.0 |
| | | • Maydan-Mahzam, 1963 | 7,000 | 19 | 24 | | | 38.0 |
| | | **Total Qatar** | | 174 | 231 | 387,000 | 4,312,876,000 | |
| **RAS al KHAIMAH(e)** | CHEVRON | • Saleh, 1983 | 14,500 | 6 | 6 | 10,000 | 20,141,000 | 50.0 |
| | | **Total Ras al Khaimah** | | 6 | 6 | 10,000 | 20,141,000 | |
| **SAUDI ARABIA(e)** | ARAMCO | Abqaiq, 1940 | 6,690 | 858 | 858 | 4,995,000 | 57,780,625,000 | 37.0 |
| | | Abu-Hadriya, 1940 | 9,340 | | | | | 35.0 |
| | | Abu Jiffan | ... | | | | | ... |
| | | • Abu-Safah, 1963 | 6,600 | | | | | 30.0 |
| | | Bakr | ... | | | | | ... |
| | | • Berri, 1964 | 8,300 | | | | | 32.0-34.0 |
| | | Dammam, 1938 | 4,800 | | | | | 35.0 |
| | | Dhib | ... | | | | | ... |
| | | Dibdibah | ... | | | | | ... |
| | | Duhul | ... | | | | | ... |
| | | El Haba | ... | | | | | ... |
| | | Fadhili, 1949 | 8,050 | | | | | 39.0 |
| | | Farhah | ... | | | | | ... |
| | | Faridah | ... | | | | | ... |
| | | Ghawar, 1948 | 6,920 | | | | | 34.0 |
| | | Habari | ... | | | | | ... |
| | | • Hamur | ... | | | | | ... |
| | | Harmaliyah, 1971 | 8,430 | | | | | 36.0 |
| | | • Harqus | ... | | | | | ... |
| | | • Hasbah | ... | | | | | ... |
| | | Jaham | ... | | | | | ... |
| | | Jaladi | ... | | | | | ... |
| | | • Jana | ... | | | | | ... |
| | | Jauf | ... | | | | | ... |
| | | Jawb | ... | | | | | ... |
| | | Juraybi'at | ... | | | | | ... |
| | | • Jurayd | ... | | | | | ... |
| | | • Karan | ... | | | | | ... |
| | | Khurais, 1957 | 5,200 | | | | | 33.0 |
| | | Khursaniyah, 1956 | 6,560 | | | | | 31.0 |
| | | • Kurayn | ... | | | | | ... |
| | | • Lawhah | ... | | | | | ... |
| | | Lughfah | ... | | | | | ... |
| | | • Maharah | ... | | | | | ... |
| | | • Manifa, 1957 | 7,950 | | | | | ... |
| | | • Marjan, 1967 | 6,800 | | | | | 33.0 |
| | | Mazalij | ... | | | | | ... |
| | | Qatif, 1945 | 7,100 | | | | | 33.0-34.0 |
| | | Qirdi | ... | | | | | ... |
| | | • Ribyan | ... | | | | | ... |
| | | Rimthan | ... | | | | | ... |
| | | • Safaniya, 1951 | 5,100 | | | | | 27.0 |
| | | Sahba | ... | | | | | ... |
| | | Samin | ... | | | | | ... |
| | | Sharar | ... | | | | | ... |
| | | Suban | ... | | | | | ... |
| | | Tinat | ... | | | | | ... |
| | | Wari'ah | ... | | | | | ... |
| | | Watban | ... | | | | | ... |
| | | • Zuluf, 1965 | 5,800 | | | | | 32.0 |
| | | **Total Saudi Arabia** | | 858 | 858 | 4,995,000 | 57,780,625,000 | |
| **SHARJAH** | AMOCO | Saaja and Moveyid, 1980 | 10,200-12,300 | 16 | 16 | 28,114 | 114,661,700 | 50.0 |
| | CRESCENT(e) | • Mubarek,(c) 1972 | ... | 4 | 4 | 6,886 | 99,450,000 | 37.0 |
| | | **Total Sharjah** | | 20 | 20 | 35,000 | 214,111,700 | |
| **SPAIN** | SHELL ESPANA | • Amposta Marino Norte, 1970 | 10,000 | ... | 8 | ... | 55,867,000 | 37.0 |
| | | • Tarraco (Castellon B5/8), 1973 | 9,000 | ... | 3 | ... | 14,547,000 | 35.0 |
| | CHEVRON | Ayoluengo, 1964 | 4,600- 5,200 | 34 | 42 | 750 | 15,379,025 | 37.0 |

| | | Name of field, discovery date | Depth, ft | No. of wells | | Production | | °API gravity |
|---|---|---|---|---|---|---|---|---|
| | | | | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | |
| | REPSOL | ● Casablanca, 1975 | 8,900 | 7 | 9 | 17,531 | 95,422,194 | 33.0 |
| | | ● Gaviota,(c) 1980 | 8,300 | 3 | 3 | 2,840 | 2,267,315 | 52.7 |
| | | ● Angula, 1984 | 12,600 | ... | 1 | ... | 17,843,906 | 44.0 |
| | | ● Dorada, 1975 | 6,700 | ... | 4 | ... | | 21.5 |
| | | ● Salmonete, 1984 | 12,600 | ... | 1 | ... | | 44.0 |
| | | **Total Spain** | | **44** | **71** | **21,121** | **201,126,440** | |
| **SURINAME** | STAATSOLIE | Tambaredjo, 1981 | 1,040 | 124 | 124 | 3,800 | 4,861,700 | 15.9 |
| | | **Total Suriname** | | **124** | **124** | **3,800** | **4,861,700** | |
| **SYRIA** | AL FURAT OIL CO. (SHELL) | Al Ishara East, 1986 | ... | ... | ... | 7,945 | 5,400,000 | 38.1 |
| | | Ash Shola, 1985 | ... | ... | ... | ... | 220,000 | 37.0 |
| | | El Ahwar, 1986 | ... | ... | ... | 5,479 | 4,500,000 | 34.0 |
| | | El Wafd North, 1986 | ... | ... | ... | 21,006 | 14,500,000 | 38.1 |
| | | Jido, 1986 | ... | ... | ... | 2,192 | 2,600,000 | 33.0 |
| | | Thayyem, 1983 | ... | ... | ... | 71,233 | 83,600,000 | 36.5 |
| | S.P.C.(e) | Alian, 1974 | 5,900 | 25 | 37 | 232,055 | 1,141,495,075 | 19.0 |
| | | Gbebeh, 1976 | 2,300 | 54 | 75 | | | 18.0 |
| | | Jebisseh, 1968 | 2,000-3,300 | 132 | 219 | | | 18.0 |
| | | Karachok, 1956 | 6,500 | 103 | 119 | | | 20.0 |
| | | Rumilan, 1962 | 6,500 | 59 | 66 | | | 24.0 |
| | | Soudie, 1959 | 6,500 | 532 | 579 | | | 24.0 |
| | | Tichrine, 1976 | 2,600 | 58 | 73 | | | 18.0 |
| | | **Total Syria** | | **963** | **1,168** | **340,000** | **1,252,315,075** | |
| **THAILAND** | UNOCAL | ● Baanpot,(c) 1980 | 7,000 | 22 | 30 | 1,863 | 2,698,500 | 54.0 |
| | | ● Erawan,(c) 1973 | 7,000 | 93 | 155 | 7,325 | 19,410,200 | 54.6 |
| | | ● Kaphong,(c) 1974 | 8,000 | 23 | 24 | 2,406 | 368,100 | 55.0 |
| | | ● Platong,(c) 1976 | 8,500 | 26 | 49 | 2,885 | 6,576,200 | 59.1 |
| | | ● Satun,(c) 1980 | 8,500 | 64 | 67 | 5,409 | 7,984,800 | 55.1 |
| | THAI SHELL | Pru Krathiam, 1984 | 4,200 | 1 | 1 | 20 | 25,700 | 19.0 |
| | | Sirikit, 1981 | 5,258-5,976 | 54 | 85 | 19,475 | 40,744,400 | 41.0 |
| | | Sirikit West, 1983 | 5,500 | 2 | 2 | 116 | 630,300 | 41.0 |
| | | Thap Raet, 1989 | 11,100 | 1 | 1 | 537 | 66,000 | 41.0 |
| | | Wat Taen, 1988 | 7,790 | 1 | 1 | 108 | 81,500 | 37.0-40.0 |
| | | **Total Thailand** | | **287** | **415** | **40,144** | **78,585,700** | |
| **TRINIDAD** | TRINIDAD & TOBAGO OIL CO. LTD. (TRINTOC) | Area IV and Guapo, 1963 | | 85 | 192 | 1,265 | 39,598,000 | |
| | | Barrackpore, 1911 | 11,100 | 83 | 379 | 3,762 | 33,301,000 | ... |
| | | Brighton, 1903 | 7,500 | 59 | 620 | 548 | 70,674,000 | ... |
| | | Catshill, 1950 | 9,693 | 31 | 134 | 300 | 23,252,000 | ... |
| | | Forest Reserve, 1913 | 11,000 | 289 | 2,042 | 3,738 | 261,724,000 | ... |
| | | Grand Ravine,* 1929 | 11,000 | 51 | 168 | 594 | 27,077,000 | ... |
| | | Guayaguayare, 1902 | 10,750 | 115 | 699 | 1,944 | 87,963,000 | ... |
| | | Oropouche, 1944 | 9,100 | 29 | 128 | 146 | 6,764,000 | ... |
| | | Palo Seco, 1929 | 12,700 | 77 | 939 | 1,652 | 94,484,000 | ... |
| | | Parrylands 1-5, 1913 | 10,626 | 118 | 508 | 1,526 | 41,268,000 | ... |
| | | Penal, 1936 | 11,067 | 76 | 289 | 982 | 62,763,000 | ... |
| | | Point Fortin C & W, 1907 | 10,626 | 124 | 551 | 1,699 | 42,047,000 | ... |
| | | Trinity, 1956 | 9,700 | 20 | 95 | 240 | 15,306,000 | ... |
| | | Other | ... | 63 | 813 | 933 | 71,817,000 | ... |
| | TRINIDAD NORTHERN AREAS (TNA) | ● Fortin Offshore (FOS), 1954 | ... | 12 | 35 | 247 | 7,185,000 | ... |
| | | ● Soldado, 1955 | 11,000 | 371 | 673 | 36,679 | 490,015,000 | ... |
| | AMOCO TRINIDAD OIL CO. LTD. | ● Cassia, 1973 | 12,700 | 9 | 10 | 4,439 | 14,184,000 | ... |
| | | Mora, 1982 | 8,500 | 4 | 6 | 427 | 728,000 | ... |
| | | ● Poui, 1974 | 11,650 | 36 | 58 | 20,274 | 164,596,000 | ... |
| | | ● Samaan, 1971 | 11,780 | 40 | 57 | 15,530 | 184,737,000 | ... |
| | | ● Teak, 1969 | 15,191 | 53 | 104 | 31,874 | 251,133,000 | ... |
| | TRINIDAD & TOBAGO PETROLEUM CO. LTD. (TRINTOPEC) | Centarl Los Bajos, 1973 | ... | 162 | 221 | 2,509 | 10,304,000 | ... |
| | | Coora/Quarry, 1936 | 14,000 | 151 | 736 | 1,720 | 92,482,000 | ... |
| | | Fyzabad/Apex/Quarry, 1920-38 | 11,000 | 300 | 1,042 | 3,062 | 173,046,000... | |
| | | Galeota, 1963 | 6,304 | 47 | 105 | 2,177 | 16,893,000 | ... |
| | | Palo Seco/Erin/McKenzie, 1926 | 12,718 | 493 | 1,581 | 7,761 | 122,996,000 | ... |
| | | Other | ... | 196 | 923 | 2,492 | 72,239,000 | ... |
| | PREMIER CONSOLIDATED OILFIELDS LTD. (P.C.O.L) | All fields | ... | 103 | 503 | 820 | 21,150,000 | ... |
| | | **Total Trinided** | | **3,199** | **13,611** | **149,340** | **2,499,726,000** | ... |
| **TUNISIA** | ELF-ETAP | ● Ashtart | 10,500 | 16 | 21 | 28,675 | 193,045,843 | 9.8 |
| | ELF-SEREPT | Douleb/Semmama, 1966 | 3,937 | 12 | 15 | 585 | 18,155,068 | ... |
| | | Tamesmida, 1967 | 3,937 | 3 | 3 | 176 | 2,151,019 | 6.9 |
| | SHELL | ● Tazerka, 1979 | ... | ... | ... | ... | 14,621,000 | 30.0 |
| | ETAP-AGIP-FINA (SODEPS) | Debbech, 1980 | 7,500 | 1 | 1 | 27 | 259,422 | 42.6 |
| | | Larich, 1979 | 7,550 | 2 | 2 | 117 | 313,851 | 40.7 |
| | | Makhrouga, 1960-69 | 6,230 | 4 | 4 | 5,318 | 7,568,176 | 45.0 |

| | | Name of field, discovery date | Depth, ft | No. of wells<br>Producing | No. of wells<br>Total | Production<br>1989 average B/d | Production<br>Cumulative to Dec. 31, 1989 Bbl | °API gravity |
|---|---|---|---|---|---|---|---|---|
| | AGIP-TUNISIA (SITEP) | Chouech es Saida, 1971 | 12,600 | 1 | 1 | 455 | 2,759,065 | 2.9 |
| | | El Borma, 1964 | 8,250- 8,900 | 87 | 113 | 28,885 | 420,131,958 | 2.5 |
| | CFPT(e) | Sidi El Itayem, 1971 | 7,500- 7,800 | 21 | 23 | 36,762 | 148,143,200 | 44.0 |
| | | **Total Tunisia** | | **147** | **183** | **103,000** | **807,148,602** | |
| **TURKEY** | ALADDIN MIDDLE EAST LTD.(e) | Kahta, 1958 | 3,500 | 12 | 25 | 1,993 | 4,778,472 | 11.0 |
| | | Yasince, 1974 | 6,400 | 2 | 4 | | | 31.0 |
| | MOBIL | Bulgurdağ, 1961 | 4,500 | 2 | 2 | 39 | 2,495,807 | 37.2 |
| | | Selmo, 1964 | 5,800 | 21 | 21 | 3,566 | 68,088,457 | 34.2 |
| | SHELL | Barbes Deep, 1971 | ... | 18 | 22 | ... | 50,000 | 37.2 |
| | | Baysu, 1985 | ... | 6 | 7 | 1,800 | 1,160,000 | 34.5 |
| | | Bektas, 1985 | ... | 1 | 1 | 380 | 440,000 | 34.7 |
| | | Beykan, 1964 | ... | 38 | 48 | 2,360 | 60,660,000 | 33.2 |
| | | Cobantepe, 1975 | ... | ... | ... | ... | 218,000 | 29.5 |
| | | Katin, 1971 | ... | 3 | 8 | ... | 3,730,000 | 29.7 |
| | | Kayako W (OF), 1964 | ... | 19 | 29 | 3,100 | 31,440,000 | 34.1 |
| | | Kayakoy, 1960 | ... | 14 | 27 | 1,340 | 20,200,000 | 38.2 |
| | | Kervan, 1982 | ... | ... | ... | ... | 4,000 | 30.3 |
| | | Kurkan, 1963 | ... | 29 | 35 | 1,420 | 49,620,000 | 31.4 |
| | | Kurkan S, 1965 | ... | 5 | 10 | 930 | 7,240,000 | 34.5 |
| | | Malatepe, 1970 | ... | 14 | 15 | 790 | 7,190,000 | 32.7 |
| | | Piyanko, 1968 | ... | 1 | 3 | ... | 1,520,000 | 36.3 |
| | | Sahaban, 1965 | ... | 7 | 13 | 540 | 13,440,000 | 34.5 |
| | | Sahaban SE, 1983 | ... | 2 | 2 | 190 | 470,000 | 34.5 |
| | | Sincan, 1979 | ... | 8 | 9 | 600 | 3,320,000 | 31.4 |
| | | Yatir E, 1973 | ... | 9 | 11 | 410 | 5,450,000 | 30.9 |
| | | Yenikoy E, 1974 | ... | 2 | 2 | 760 | 4,570,000 | 31.3 |
| | | Yesildere, 1985 | ... | 3 | 3 | 550 | 597,000 | 34.5 |
| | TPAO | Adiyaman, 1971 | 5,800 | 8 | 8 | 506 | 8,420,930 | 27.8 |
| | | Akpinar, 1984 | 10,500 | 4 | 4 | 67 | 157,937 | 31.6 |
| | | Alcik, 1983 | 6,500 | 1 | 1 | 36 | 95,486 | 32.0 |
| | | B. Firat, 1986 | 8,150 | 11 | 11 | 1,137 | 1,754,761 | 34.8 |
| | | B. Kozluca, 1985 | 5,000 | 23 | 23 | 933 | 1,563,510 | 12.0 |
| | | B. Selmo, 1981 | 5,500 | 4 | 4 | 288 | 739,096 | 34.0 |
| | | Bati Raman, 1961 | 4,200 | 112 | 112 | 6,344 | 37,884,010 | 13.3 |
| | | Beycayir, 1976 | 7,700 | 1 | 1 | 29 | 207,804 | 26.4 |
| | | Bölükyayla, 1977 | 10,300 | ... | ... | ... | 167,683 | 35.0 |
| | | Camurlu, 1976 | 5,600 | 14 | 14 | 420 | 1,186,859 | 12.2 |
| | | Celikli, 1964 | 10,500 | 11 | 11 | 868 | 3,821,585 | 35.2 |
| | | Cemberlitas, 1983 | 6,500 | 20 | 20 | 2,859 | 8,135,017 | 30.5 |
| | | Cukurtas, 1985 | 10,000 | 1 | 1 | 23 | 219,021 | 36.0 |
| | | Devecatak, 1973 | 4,800 | 2 | 2 | 66 | 272,735 | 37.0 |
| | | G. Adiyaman, 1977 | 5,000 | ... | ... | ... | 115,836 | 20.4 |
| | | G. Dincer, 1981 | 5,350 | 15 | 15 | 902 | 4,861,381 | 16.7 |
| | | G. Karakus, 1989 | 7,900 | 1 | 1 | 265 | 39,691 | 26.5 |
| | | G. Kayaköy, 1976 | 8,600 | 4 | 4 | 416 | 2,347,288 | 30.4 |
| | | G. Sahaban, 1978 | 5,450 | 9 | 9 | 807 | 3,234,655 | 33.2 |
| | | G. Saricak, 1973 | 5,250 | 12 | 12 | 160 | 4,384,785 | 31.5 |
| | | Garzan, 1956 | 4,700 | 24 | 24 | 1,147 | 33,360,978 | 26.2 |
| | | Germik, 1968 | 6,500 | 10 | 10 | 294 | 3,508,066 | 18.3 |
| | | Ikiztepe, 1976 | 4,900 | ... | ... | ... | 88,051 | 11.3 |
| | | K. Osmancik, 1971 | 3,800 | 3 | 3 | 230 | 2,172,980 | 37.6 |
| | | Karakus, 1988 | 8,850 | 10 | 10 | 8,673 | 3,236,560 | 30.0 |
| | | Karteltepe, 1982 | 6,550 | 3 | 3 | 366 | 1,017,971 | 32.0 |
| | | Kurtalan, 1961 | 5,750 | 1 | 1 | 26 | 252,180 | 31.9 |
| | | Kuzey Adiyaman, 1977 | 9,500 | ... | .. | ... | 59,375 | 32.0 |
| | | Mağrip, 1961 | 5,700 | 11 | 11 | 658 | 15,11,439 | 18.4 |
| | | Mehmetdere, 1982 | 6,700 | ... | ... | ... | 157,439 | 31.0 |
| | | Oyuktas, 1972 | 7,600 | ... | ... | ... | 592,005 | 31.0 |
| | | Raman, 1940 | 4,500 | 80 | 80 | 4,583 | 52,063,105 | 18.7 |
| | | S. Sinan, 1987 | 3,900 | 3 | 3 | 161 | 119,003 | 13.0 |
| | | Saricak, 1973 | 5,250 | 5 | 5 | 221 | 2,737,116 | 31.5 |
| | | Sezgin, 1970 | 5,600 | ... | ... | ... | 87,559 | 17.0 |
| | | Silivanka, 1962 | 8,200 | 11 | 11 | 808 | 8,027,847 | 23.0 |
| | | Sivritepe, 1977 | 8,200 | ... | ... | ... | 591,769 | 33.4 |
| | | Yeniköy, 1973 | 6,400 | 23 | 23 | 1,937 | 9,768,385 | 31.4 |
| | | **Total Turkey** | | **653** | **734** | **56,000** | **488,243,632** | |
| **UNITED KINGDOM** | AMOCO | • Montrose, 1969 | 8,100 | 13 | 15 | 3,640 | 79,613,090 | 40.0 |
| | | • NW Hutton, 1975 | 11,200 | 32 | 35 | 17,571 | 94,920,109 | 36.0 |
| | ARCO | • Thames,(c) 1973 | 7,892 | 6 | 7 | 148 | 222,000 | 48.8 |
| | BP(e) | • Beatrice (A & B), 1976 | 6,750 | 27 | 39 | 478,888 | 2,918,163,942 | 36.4 |
| | | • Buchan, 1974 | 8,700 | 9 | 9 | | | 33.0 |
| | | • Clyde, 1978 | 12,400 | 10 | 30 | | | 38.1 |
| | | • Deveron, 1972 | 9,000 | 3 | 3 | | | 36.2 |
| | | East Midlands, 1939 | 3,500 | 65 | 132 | | | 36.0 |
| | | • Forties and Echo, 1970 | 7,000 | 79 | 103 | | | 37.0 |
| | | Kimmeridge, 1959 | 1,705 | 1 | 1 | | | 40.0 |

| | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|
| | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | ● Magnus, 1974 | 9,500 | 11 | 11 | | | 39.0 |
| | Nettleham, 1983 | 8,850 | 1 | 2 | | | 35.0 |
| | Stainton, 1984 | 5,200 | 1 | 3 | | | ... |
| | Scampton, 1985 | 5,360 | ... | 3 | | | ... |
| | ● Thistle, 1973 | 9,000 | 33 | 52 | | | 38.0 |
| | Welton, 1981 | 5,000 | ... | ... | | | 36.0 |
| | Wytch Farm Bridport Sand, 1974 | 3,031 | 10 | 16 | | | 37.0 |
| | Wytch Farm Sherwood Sandstone, 1978 | 5,198 | 5 | 5 | | | 37.9 |
| **CHEVRON** | ● Ninian, 1974 | 10,000 | 69 | 105 | 130,426 | 858,229,932 | 35.6 |
| **CONOCO** | ● Dunlin, 1973 | 9,100 | 26 | 41 | 39,408 | 273,335,000 | 36.0 |
| | ● Hutton, 1973 | 10,000 | 16 | 29 | 41,253 | 117,430,506 | 33.0 |
| | ● Murchison*, 1975 | 9,900 | 18 | 30 | 28,595 | 202,267,164 | 38.0 |
| | ● Statfjord†, 1974 | 9,500 | 59 | 93 | 110,833 | 275,375,974 | 39.0 |
| **HAMILTON BROS. OIL & GAS LTD.** | ● Argyll, 1971 | 9,000- 9,400 | 7 | 7 | 5,790 | 68,230,000 | 38.0 |
| | ● Crawford, 1975 | 6,900- 8,500 | 4 | 4 | 5,830 | 2,130,000 | 30.0 |
| | ● Duncan, 1980 | 9,600-10,000 | 2 | 2 | 1,440 | 17,980,000 | 36.0 |
| | ● Innes, 1983 | 12,300-12,600 | 2 | 2 | 1,190 | 5,440,000 | 45.0 |
| **MARATHON** | ● Central Brae crude oil, 1976 | 14,100-15,000 | 3 | 3 | 3,100 | 1,105,000 | 33.0 |
| | ● North Brae condensate, 1975 | 11,900-12,475 | 10 | 13 | 69,600 | 36,603,000 | 45.0 |
| | ● South Brae crude oil, 1975 | 12,700-13,437 | 17 | 27 | 48,800 | 213,114,000 | 35.0 |
| **MOBIL** | ● Beryl, 1972 | 9,900-11,500 | 38 | 48 | 98,352 | 427,369,427 | 37.0 |
| | ● Linnhe, 1988 | 11,500-12,065 | 1 | 1 | 469 | 171,286 | 37.8 |
| | ● Ness, 1986 | 9,900-10,112 | 3 | 4 | 13,524 | 13,164,501 | 37.0 |
| **OCCIDENTAL** | ● Claymore, 1974 | 8,100 | 5 | 29 | 4,705 | 324,709,332 | 30.1 |
| | ● Piper, 1973 | 8,100 | ... | ... | ... | 834,416,000 | 37.0 |
| | ● Scapa, 1981 | 8,100 | 4 | 5 | 11,868 | 21,287,150 | 32.0 |
| **SHELL** | ● Auk, 1971 | ... | 9 | 11 | 6,301 | 2,700,000 | 38.0 |
| | ● Brent, 1971 | ... | 53 | 130 | 198,630 | 1,277,400,000 | 40.0 |
| | ● Cormorant, 1972 | ... | 17 | 37 | 70,137 | 324,200,000 | 36.0 |
| | ● Dunlin , 1973 | ... | 26 | 40 | 25,565 | 317,254,000 | 36.0 |
| | ● Eider, 1976 | ... | ... | ... | 30,904 | 15,200,000 | 34.0 |
| | ● Fulmar, 1975 | ... | 13 | 28 | 117,494 | 392,145,000 | 40.0 |
| **PHILLIPS** | ● Maureen, 1973 | 8,000- 8,700 | 7 | 12 | 48,777 | 154,878,640 | 35.9 |
| **TEXACO NORTH SEA** | ● Highlander, 1976 | 8,759- 9,372 | 5 | 7 | 22,100 | 40,623,000 | 34.0 |
| | ● Petronella, 1975 | 8,110 | 1 | 1 | 11,000 | 10,654,000 | 40.2 |
| | ● Tartan, 1974 | 10,217-12,614 | 7 | 5 | 16,700 | 72,157,000 | 38.0 |
| **TOTAL OIL MARINE** | ● Alwyn North, 1975 | ... | 9 | 29 | 90,000 | 57,301,000 | 40.0-41.0 |
| **UNOCAL** | ● Heather, 1973 | 10,800 | 25 | 40 | 11,962 | 84,180,446 | 34.3 |
| | **Total United Kingdom** | | **762** | **1,259** | **1,773,000** | **9,613,970,508** | |
| **VENEZUELA** | | | | | | | |
| **PDVSA/ ZULIA** | Alturitas | ... | 7 | 14 | 1,745 | 3,346,087 | 32.2 |
| | Bachaquero, 1930 | 10,720 | 1,850 | 3,709 | 215,868 | 6,541,430,236 | 22.9 |
| | Boscan, 1946 | 9,708 | 76 | 478 | 19,381 | 747,254,243 | 10.2 |
| | Cabimas, 1917 | 2,200 | 522 | 1,234 | 48,620 | 1,638,449,492 | 22.4 |
| | Centro, 1959 | 9,600-11,000 | 329 | 606 | 135,853 | 936,775,718 | 33.6 |
| | Ceuta | 16,380 | 110 | 179 | 65,565 | 477,291,615 | 30.2 |
| | Cruces-Manueles, 1916 | 3,000- 8,000 | 41 | 133 | 1,302 | 177,289,790 | 30.2 |
| | La Concepcion, 1953 | 3,148- 8,000 | 52 | 162 | 3,297 | 138,735,445 | 30.1 |
| | La Paz, 1925 | 4,268- 8,000 | 57 | 154 | 10,136 | 862,352,054 | 30.1 |
| | Lago, 1959 | 11,450 | 30 | 66 | 17,501 | 241,447,842 | 30.5 |
| | Lagunillas, 1926 | 3,000 | 2,609 | 5,187 | 346,050 | 10,954,851,444 | 22.0 |
| | Lama, 1957 | 8,320 | 1,941 | 348 | 138,246 | 2,629,778,032 | 32.2 |
| | Lamar, 1958 | 13,000 | 108 | 186 | 70,491 | 1,162,688,577 | 33.5 |
| | Mara, 1945 | 5,240 | 37 | 105 | 4,899 | 415,588,131 | 26.6 |
| | Mene Grande, 1914 | 4,130 | 170 | 583 | 953 | 673,630,970 | 19.9 |
| | Motatan, 1952 | ... | 27 | 30 | 42,977 | 100,625,197 | 22.0 |
| | Sibucana, 1948 | 13,450 | ... | 1 | ... | 43,418,125 | ... |
| | Tia Juana, 1928 | 3,000 | 1,801 | 3,079 | 130,114 | 4,058,506,604 | 17.9 |
| | Urdaneta, 1970 | 10,000 | 152 | 283 | 35,989 | 152,274,347 | 22.0 |
| | West-Tarra, 1942 | 4,250- 5,500 | 20 | 44 | 2,465 | 74,003,614 | 30.2 |
| | Other | ... | 135 | 408 | 31,341 | 2,042,929,176 | |
| **PDVSA/ ANZOA-TEGUI** | Adjuntas, 1957 | 5,000 | ... | 54 | ... | 8,714,849 | 3.9 |
| | Arecuna | 1,300 | 53 | 118 | 3,742 | 10,997,661 | 11.0 |
| | Bare | 1,110 | 158 | 275 | 13,800 | 25,850,123 | 10.2 |
| | Caico Seco, 1946 | 6,500- 7,300 | 2 | 8 | 381 | 8,981,806 | 31.8 |
| | Chimire, 1948 | 7,000- 7,200 | 50 | 190 | 2,655 | 122,907,767 | 31.1 |
| | Dacion, 1957 | 6,700 | 70 | 140 | 7,914 | 229,438,085 | 23.0 |
| | El Roble, 1939 | 3,500-11,500 | 24 | 58 | 2,070 | 43,107,831 | 49.3 |
| | El Toco | 2,300 | 27 | 43 | 866 | 15,795,449 | 23.7 |
| | Elias, 1954 | 5,000- 6,470 | 44 | 220 | ... | ... | ... |
| | Guara, 1946 | 5,000-10,000 | 102 | 221 | 3,986 | 249,620,996 | 27.0 |
| | Guario, 1940 | 3,400 | 18 | 59 | 743 | 27,232,886 | 43.6 |
| | Isla, 1954 | ... | 21 | 67 | 4,731 | 57,938,711 | 40.5 |
| | La Ceiba, 1946 | 9,450 | 22 | 37 | 3,381 | 49,682,318 | 41.9 |
| | La Ceibita, 1963 | 9,878 | 19 | 47 | 1,978 | 83,320,150 | 42.0 |
| | Leona, 1938 | 2,200-12,800 | 16 | 63 | 1,222 | 51,881,445 | 26.7 |

*U.K. share (77.8%) of total production. †U.K. share (15.91%) of total production.

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | | Mata, 1954 | 8,970-10,516 | 76 | 385 | 4,016 | 54,787,078 | 35.9 |
| | | Merey, 1937 | 5,400- 5,700 | 17 | 41 | ... | 34,579,770 | 12.5 |
| | | Nipa, 1945 | 6,000- 8,500 | 35 | 187 | 1,800 | 120,273,230 | 29.6 |
| | | Oficina, 1937 | 5,900 | 34 | 104 | 1,806 | 361,270,333 | 26.1 |
| | | Oscurote-Norte, 1952 | 9,513 | 10 | 77 | 1,171 | 113,024,585 | 24.2 |
| | | Pato Este, 1988 | ... | 2 | ... | 193 | 78,502,618 | 41.9 |
| | | San Joaquin, 1939 | 6,550 | 66 | 108 | 2,160 | 48,780,081 | 51.3 |
| | | Soto, 1950 | 9,500 | 14 | 82 | ... | ... | ... |
| | | Sta. Ana, 1936 | 8,500 | 48 | 97 | 2,473 | 61,975,184 | 45.6 |
| | | Sta. Rosa, 1941 | 8,500 | 166 | 210 | 7,901 | 291,608,541 | 45.7 |
| | | Yopales, 1937 | 4,600 | 94 | 203 | 4,990 | 66,410,170 | 22.6 |
| | | Zanjas, 1958 | 13,270 | 6 | 17 | 1,359 | 40,741,295 | 38.1 |
| | | Zapatos, 1955 | 11,500 | 28 | 58 | 3,336 | 181,250,848 | 32.4 |
| | | Zorro, 1953 | 11,100 | 8 | 29 | 1,520 | 74,645,449 | 29.3 |
| | | Zulus, 1957 | 12,710 | 7 | 23 | 1,587 | 24,953,350 | 41.2 |
| | | Zumo, 1954 | 9,200 | 4 | 35 | 910 | 70,616,083 | 25.3 |
| | | Other | ... | 541 | 2,021 | 98,603 | 2,929,648,421 | ... |
| | PDVSA/MONAGAS | Acema, 1960 | ... | 26 | 56 | 11,743 | 57,397,773 | 26.4 |
| | | Acema-Casma | 4,023 | 36 | 85 | 12,662 | 85,318,167 | 24.3 |
| | | Aguasay, 1955 | 8,100-13,400 | 21 | 72 | 1,354 | 81,535,764 | 41.3 |
| | | Aguasay Norte/Sur, 1955 | 4,849 | 6 | 17 | 1,675 | 4,946,943 | 42.4 |
| | | Carisito, 1984 | 4,881 | 7 | 8 | 6,767 | 6,168,079 | 41.7 |
| | | Carito, 1988 | ... | 4 | 6 | 25,778 | 11,338,247 | 31.4 |
| | | Cerro Negro | 1,200 | 43 | 296 | 6,444 | 24,737,881 | 9.0 |
| | | Furrial, 1986 | ... | 17 | 18 | 136,959 | 80,392,219 | 26.3 |
| | | Jobo, 1956 | 3,600- 4,000 | 147 | 432 | 25,392 | 289,183,963 | 10.3 |
| | | Mata Acema, 1951 | ... | 33 | 56 | 5,600 | 93,649,415 | 27.0 |
| | | Morichal, 1958 | 3,312 | 19 | 189 | 1,930 | 172,329,996 | 9.2 |
| | | Onado, 1971 | 4,791 | 5 | 25 | 1,152 | 19,594,004 | 28.0 |
| | | Oritupano, 1950 | 7,657 | 29 | 64 | 3,262 | 38,659,692 | 18.4 |
| | | Oritupano Norte/Sur, 1954 | ... | 24 | 253 | 7,261 | 30,357,856 | 24.1 |
| | | Orocual, 1953 | 2,954 | 8 | 57 | 1,708 | 30,826,639 | 25.1 |
| | | Pilon, 1937 | ... | 45 | 139 | 7,491 | 156,598,659 | 11.6 |
| | | Pirital, 1958 | 450- 1,100 | ... | 84 | ... | 27,535,135 | ... |
| | | Quiriquire, 1928 | 7,000- 7,200 | 3 | 474 | 1,298 | 761,301,593 | 27.7 |
| | | Sta. Barbara, 1941 | 5,020- 6,500 | 1 | 331 | 6,716 | 169,782,969 | 31.4 |
| | | Tacat, 1953 | 1,820- 3,670 | ... | 133 | ... | 45,209,945 | ... |
| | | Tembiador, 1936 | 3,500- 4,500 | 3 | 49 | 837 | 109,621,745 | 18.7 |
| | | Other | ... | 63 | 305 | 28,295 | 615,933,764 | ... |
| | PDVSA/BARINAS | Guafita, 1984 | 8,500 | 21 | 22 | 57,226 | 49,921,084 | 29.1 |
| | | Hato, 1965 | 9,550 | 18 | 16 | 2,349 | 44,525,088 | 22.7 |
| | | La Victoria, 1987 | ... | 6 | 6 | 11,727 | 6,033,547 | 34.5 |
| | | Maporal, 1957 | 10,950 | 12 | 16 | 3,107 | 17,141,820 | 25.7 |
| | | Paez, 1963 | ... | 45 | 67 | 7,164 | 66,895,836 | 19.9 |
| | | Silvan, 1949 | 10,860 | 18 | 22 | 3,142 | 50,844,701 | 26.8 |
| | | Silvestre, 1948 | 8,860 | 19 | 48 | 2,849 | 138,382,915 | 22.1 |
| | | Sinco, 1953 | 8,500- 9,100 | 49 | 84 | 5,901 | 262,316,155 | 21.5 |
| | | Other | ... | 3 | 7 | 342 | 5,285,014 | ... |
| | PDVSA/GUARICO | Barzo, 1959 | ... | 3 | 6 | 92 | 2,388,097 | 24.0 |
| | | Bella Vista, 1952 | ... | 8 | 86 | ... | ... | ... |
| | | Budare, 1958 | 4,523 | 23 | 44 | 10,977 | 72,274,969 | 31.1 |
| | | Jobal, 1960 | ... | 8 | 12 | 74 | 2,200,027 | 33.6 |
| | | Las Mercedes, 1942 | 4,500 | ... | 184 | ... | 91,650,680 | ... |
| | | Ruiz, 1949 | 4,500 | ... | 42 | ... | 33,189,615 | ... |
| | | Saban, 1947 | ... | 8 | 70 | 251 | 22,240,027 | 43.9 |
| | | Other | ... | 115 | 207 | 5,493 | 363,236,638 | ... |
| | PDVSA/AMACURO | Tucupita, 1945 | ... | ... | 48 | ... | 67,074,169 | ... |
| | PDVSA/FALCON | All fields, 1920 | ... | ... | ... | ... | 107,226,375 | 27.4 |
| | | **Total Venezuela** | | 12,752 | 26,402 | 1,909,105 | 43,926,451,082 | |
| **WEST GERMANY** | BEB | Annaveen, 1963 | 4,428 | ... | 4 | ... | 500,475 | 33.8 |
| | | Barenburg, 1953 | 2,300- 3,300 | 43 | 72 | 1,974 | 40,731,540 | 29.0 |
| | | Barver, 1963 | 3,640 | 2 | 5 | 30 | 502,901 | 32.8 |
| | | Bodenteich, 1960 | 4,641 | 1 | 2 | 18 | 361,509 | 31.1 |
| | | Eich, 1983 | 5,995 | 7 | 8 | 1,650 | 2,102,345 | 38.9 |
| | | Eilte-West, 1956 | 6,051 | 12 | 16 | 85 | 3,633,888 | 32.8 |
| | | Eldingen, 1949 | 5,028 | 36 | 43 | 723 | 21,262,463 | 35.5 |
| | | Elsfleth, 1956 | 5,175 | 3 | 8 | 35 | 2,660,587 | 25.7 |
| | | Eystrup 2, 1960 | 3,526 | ... | 1 | ... | 444,798 | 17.4 |
| | | Eystrup 3-6, 1959 | 1,075 | 4 | 4 | 83 | 1,177,255 | 17.4 |
| | | Eystrup-Verden, 1977 | 3,526 | ... | 4 | 1 | 180,280 | 17.1 |
| | | Georgsdorf, 1944 | 1,800- 2,600 | 196 | 369 | 5,300 | 104,005,149 | 24.0-29.0 |
| | | Gross Lessen, 1969 | 3,300 | 6 | 11 | 557 | 21,231,936 | 30.0 |
| | | Hankensbüttel, Mitte, 1954 | 5,182 | 5 | 8 | 287 | 4,496,989 | 33.0 |
| | | Hankensbüttel-Nord, 1955 | 5,182 | 4 | 4 | 316 | 6,429,186 | 33.0 |
| | | Hankensbüttel, Ost, 1954 | 5,182 | 1 | 1 | 46 | 1,290,049 | 33.0 |
| | | Hebelermeer, 1955 | 3,891 | 5 | 15 | 73 | 4,550,102 | 27.3 |
| | | Hillerse-Nord, 1958 | 2,683 | 1 | 1 | 9 | 772,698 | 31.5 |
| | | Hillerse-West, 1957 | 6,077 | 1 | 1 | 2 | 29,815 | 43.1 |
| | | Hohenassel, 1943 | 1,705 | 6 | 14 | 22 | 3,558,034 | 30.4 |

| | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|
| | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| | Hohnebostel, 1969 | 8,341 | 2 | 6 | 57 | 1,226,842 | 41.0 |
| | Königsgarten, 1984 | 6,235 | 3 | 3 | 337 | 247,639 | 38.1 |
| | Lingen-Dal. (incl. Wd), 1942 | 3,129 | 46 | 128 | 132 | 16,995,157 | 31.1 |
| | Lüben, 1955 | 3,950 | 7 | 11 | 585 | 12,445,058 | 35.0-38.0 |
| | Lüben-West, 1958 | 4,690 | 5 | 6 | 133 | 1,586,475 | 36.9 |
| | Meerdorf, 1954 | 6,077 | 14 | 27 | 62 | 1,632,811 | 43.1 |
| | Meppen-Schwefingen, 1959 | 4,257 | 22 | 24 | 843 | 12,818,086 | 29.8 |
| | Mölme-Feldbergen, 1934 | 1,410 | 2 | 2 | 12 | 597,238 | 31.1 |
| | Mölme-Wachtel, 1934 | 3,886 | 2 | 10 | 3 | 904,044 | 36.9 |
| | Nienhagen, 1909 | 3,079 | 10 | 26 | 167 | 26,895,965 | 29.6 |
| | Nienhagen-Dachtmissen, 1959 | 3,427 | 5 | 8 | 89 | 1,046,892 | 27.8 |
| | Pfullendorf-Ostrach, 1962 | 3,558 | 15 | 23 | 131 | 2,575,180 | 37.7 |
| | Pötrau, 1959 | 5,248 | ... | 2 | ... | 31,121 | 14.3 |
| | Rühlermoor-Malm, 1962 | 4,519 | 6 | 10 | 210 | 6,541,938 | 31.7 |
| | Rühlermoor-Valendis, 1949 | 2,381 | 248 | 443 | 10,885 | 139,735,749 | 24.6 |
| | Rühme, 1954 | 1,950 | 38 | 48 | 682 | 10,719,373 | 33.4 |
| | Steimbke-Alt + Nord, 1935 | 1,246 | 18 | 30 | 76 | 7,756,810 | 20.6 |
| | Steimbke-Lichtenmoor, 1943 | 2,722 | 14 | 29 | 109 | 4,020,591 | 17.4 |
| | Steimbke-Ost, 1959 | 4,428 | 3 | 9 | 51 | 3,836,847 | 30.5 |
| | Stockstadt, 1952 | 5,402 | 11 | 21 | 120 | 7,749,995 | 39.6 |
| | Suderbruch, 1949 | 5,175 | 41 | 64 | 494 | 23,740,686 | 31.1 |
| | Sulingen, 1973 | 3,345 | 9 | 9 | 442 | 5,353,332 | 30.0 |
| | Varel, 1957 | 5,084 | 6 | 15 | 143 | 5,793,000 | 25.5 |
| | Varloh, 1984 | 4,129 | 6 | 6 | 138 | 349,590 | 31.5 |
| | Volkensen, 1960 | 7,540 | 4 | 4 | 77 | 807,340 | 22.9 |
| | Wehrbleck, 1957 | 3,342 | 50 | 61 | 623 | 16,867,171 | 32.0 |
| | Wietingsmoor, 1954 | 2,820 | 22 | 30 | 483 | 13,388,438 | 30.5 |
| **MOBIL** | Bavaria | 5,640- 6,190 | ... | 20 | ... | 7,526,952 | 20.0 |
| | Hannover | 980- 6,630 | 49 | 68 | 810 | 31,296,759 | 25.0-35.0 |
| | Hofolding, 1980 | 11,100 | 3 | 3 | 300 | 1,105,204 | 28.0-30.0 |
| | Süd-Oldenburg, 1950 | 2,630- 6,800 | 84 | 137 | 1,101 | 40,332,556 | 31.0-39.0 |
| | Voigtei, 1953 | 980- 1,900 | 74 | 106 | 633 | 25,385,230 | 32.0-34.0 |
| | Weser Ems | 2,000- 2,450 | 18 | 25 | 292 | 6,212,439 | 24.0 |
| **RWE-DEA A.G.** | Boostedt, 1952 | 5,900 | 26 | 45 | 502 | 18,568,187 | 2.0 |
| | Hankensbuettel-Sued, 1954 | 4,900 | 37 | 81 | 1,881 | 83,272,415 | 7.0-35.0 |
| | Hardesse, 1957 | 8,200 | 28 | 67 | 442 | 9,016,774 | ... |
| | Hohne, 1951 | 5,250 | 27 | 55 | 737 | 41,208,241 | 3.0 |
| | Leiferde, 1956 | 2,600 | 21 | 42 | 364 | 20,524,815 | 3.0 |
| | • Mittelplate, 1987 | 7,500- 9,350 | 5 | 6 | 4,517 | 3,500,160 | 9.3 |
| | Oerrel-Sued, 1954 | 4,600 | 22 | 47 | 636 | 11,955,623 | 6.0 |
| | Ploen-Ost, 1958 | 8,850 | 29 | 83 | 870 | 51,398,026 | 3.0 |
| | Preetz, 1962 | 8,200 | 15 | 33 | 286 | 11,746,832 | 6.0 |
| | Schwedeneck-See, 1978 | 4,900 | 15 | 18 | 7,053 | 13,124,057 | 8.0 |
| | Wesendorf, 1943 | 4,650 | 13 | 36 | 347 | 17,648,816 | 5.0-40.0 |
| | Other, 1935 | 2,300- 8,200 | 17 | 73 | 420 | 31,289,513 | 9.0-37.0 |
| **WINTERSHALL A.G.** | Aitingen, 1977 | 6,232 | 4 | 4 | 933 | 4,668,321 | 31.1 |
| | Aldorf, 1952 | 4,100 | 29 | 103 | 421 | 17,247,936 | 33.0 |
| | Arlesried, 1964 | 4,920- 8,550 | 13 | 18 | 466 | 14,190,315 | 38.5 |
| | Bockstedt, 1954 | 4,264 | 28 | 40 | 1,026 | 21,197,314 | 27.4 |
| | Dickel, 1953 | 3,936 | 32 | 59 | 294 | 6,826,501 | 28.3 |
| | Dueste, 1954 | 3,936 | 28 | 71 | 271 | 12,250,670 | 33.0 |
| | Eicklingen, 1937 | 2,460 | 9 | 13 | 51 | 3,680,337 | 30.0 |
| | Emlichheim, 1944 | 3,116 | 87 | 160 | 2,936 | 45,498,458 | 24.5 |
| | Hauerz, 1985 | 8,639 | 4 | 4 | 108 | 290,815 | 40.4 |
| | Kirchdorf, 1982 | 5,737 | 1 | 1 | 12 | 60,955 | 38.5 |
| | Landau, 1955 | 3,936 | 77 | 82 | 1,143 | 27,513,710 | 36.9 |
| | Maximiliansau, 1959 | 2,100- 5,363 | ... | ... | ... | 14,387 | 41.0 |
| | Meckelfeld, 1954 | 6,396 | 17 | 28 | 246 | 14,116,718 | 27.5 |
| | Moenchsrot, 1958 | 5,248 | 16 | 22 | 281 | 10,675,677 | 38.1 |
| | Nienhagen, 1925 | 3,729 | 12 | 12 | 64 | 10,945,356 | 30.0 |
| | Oberschwarzach, 1978 | 4,920 | 4 | 4 | 113 | 710,515 | 37.7 |
| | Pattensen, 1954 | 2,165 | 6 | 7 | 52 | 1,077,932 | 29.3 |
| | Rheinzabern, 1959 | 3,750- 5,576 | ... | 1 | ... | 27,041 | 37.9 |
| | Ruehlertwist, 1949 | 2,350- 2,900 | 70 | 134 | 1,496 | 32,135,700 | 25.0 |
| | Ruelzheim, 1984 | 7,544 | ... | 2 | ... | 40,818 | 37.7 |
| | Schwabmuenchen, 1976 | 4,428 | ... | 1 | ... | 39,491 | 25.7 |
| | Schwedeneck (only onshore), 1956 | 5,182 | 13 | 29 | 177 | 5,275,233 | 27.5 |
| | Wathlingen, 1939 | 2,624 | 7 | 10 | 24 | 1,422,000 | 30.0 |
| **DST**(*) | Bramberge, 1958 | 2,560- 3,300 | 57 | 82 | | | 29.0 |
| | Fronhofen, 1964 | 3,800 | 10 | 15 | | | 37.0 |
| | Illmensee, 1967 | 3,800 | 2 | 5 | | | 37.0 |
| | Markdorf, 1960 | 7,700 | ... | 1 | | | 37.0 |
| | Memmingen-M, 1958 | 5,000 | ... | 7 | | | 37.0 |
| **OTHER OPERATORS**(*) | Scheerhorn, 1949 | 3,550- 3,750 | | | 14,433 | 391,523,950 | 30.0 |
| | Reitbrook, 1937 | 1,450- 2,100 | | | | | 29.0 |
| | Oelheim-Sued, 1968 | 7,650 | 932 | 1,630 | | | 33.0 |
| | Sinstorf, 1960 | 6,750- 7,150 | | | | | ... |
| | Vorhop, 1952 | 2,950- 6,900 | | | | | 36.0 |
| | **Total West Germany** | | **2,883** | **5,144** | **74,000** | **1,592,328,114** | |

| | | | | No. of wells | | Production | | |
|---|---|---|---|---|---|---|---|---|
| | | Name of field, discovery date | Depth, ft | Producing | Total | 1989 average B/d | Cumulative to Dec. 31, 1989 Bbl | °API gravity |
| **YEMEN** | HUNT OIL | Alif, 1984 | 5,750 | 55 | 56 | 152,500 | 118,170,200 | 40.0 |
| | | Al-Shura, 1989 | 7,600 | 1 | 1 | 100 | 41,300 | 40.0 |
| | | Azal, 1987 | 6,850 | 12 | 12 | 22,900 | 13,507,400 | 40.0 |
| | | Jabal, Nuqum, 1988 | 3,780 | 1 | 1 | 1,300 | 466,500 | 44.0 |
| | | Saif Ben The-Yazen, 1988 | 7,600 | 1 | 1 | 1,300 | 470,500 | 40.0 |
| | | **Total North Yemen** | | 70 | 71 | 178,100 | 132,655,900 | |
| **YUGOSLAVIA** | INA-NAFTAPLIN | Beničanci, 1966 | 6,752- 5,938 | 34 | 70 | 5,583 | 106,071,169 | 30.2 |
| | | Bilogora, 1966 | 3,346- 5,052 | 43 | 60 | 822 | 8,359,466 | 40.8 |
| | | Bizovac, 1989 | 5,483- 5,499 | 1 | 5 | 264 | 32,235 | 33.8 |
| | | Bokšić-Klokočevci, 1975 | 7,218-10,171 | 12 | 19 | 119 | 234,820 | 31.0 |
| | | Bunjani, 1951 | 1,800- 2,550 | 19 | 36 | 69 | 2,514,916 | 30.2 |
| | | Crnac, 1977 | 6,814- 8,061 | 2 | 4 | 286 | 208,827 | 34.6 |
| | | Deletovci, 1982 | 3,143- 3,422 | 44 | 51 | 4,036 | 6,180,054 | 28.9 |
| | | Dugo Selo, 1953 | 3,445- 4,183 | 15 | 26 | 469 | 9,785,176 | 31.1 |
| | | Ferdinandovac, 1959 | 5,625- 5,915 | 5 | 6 | 102 | 1,286,776 | 36.0 |
| | | Ilača, 1982 | 3,445- 3,855 | 9 | 14 | 362 | 407,404 | 31.1 |
| | | Ivanič Grad, 1959 | 5,282- 5,709 | 46 | 85 | 3,479 | 44,149,246 | 33.4 |
| | | Jagnjedovac, 1961 | 2,864- 3,570 | 26 | 32 | 475 | 6,399,537 | 33.0 |
| | | Jamarice, 1965 | 3,281- 5,512 | 90 | 124 | 2,672 | 14,229,838 | 37.6 |
| | | Ježevo, 1963 | 6,234- 7,382 | 7 | 9 | 91 | 859,548 | 36.7 |
| | | Kloštar, 1952 | 2,297- 4,593 | 74 | 137 | 1,010 | 40,424,057 | 36.3 |
| | | Kozarice, 1972 | 3,281- 3,609 | 16 | 23 | 407 | 1,632,613 | 23.6 |
| | | Križ, 1948 | 1,600- 2,250 | 32 | 110 | 90 | 6,494,756 | 17.4 |
| | | Kučanci-Kapelna, 1973 | 6,562- 7,218 | 12 | 14 | 1,359 | 1,378,110 | 25.2 |
| | | Laciči, 1979 | 7,605- 8,012 | 8 | 20 | 2,248 | 4,342,624 | 35.6 |
| | | Lepavina, 1969 | 1,780- 2,200 | 8 | 11 | 297 | 838,671 | 22.8 |
| | | Letičani, 1989 | 4,584- 4,817 | 5 | 9 | 108 | 39,285 | 35.0 |
| | | Lipovljani, 1960 | 3,937- 5,709 | 81 | 112 | 2,553 | 22,147,253 | 36.7 |
| | | Lupoglav, 1971 | 3,860- 5,600 | 5 | 6 | 93 | 140,549 | 33.4 |
| | | Mihovljani, 1973 | 5,150- 5,760 | 4 | 5 | 92 | 59,452 | 32.5 |
| | | Molve,(c) 1974 | 10,263-11,345 | 16 | 20 | 1,175 | 2,178,050 | 57.2 |
| | | Mramor Brdo, 1949 | 2,625- 4,101 | 4 | 30 | 49 | 4,539,835 | 31.1 |
| | | Obod, 1967 | 6,378- 7,550 | 3 | 8 | 156 | 2,224,427 | 32.5 |
| | | Okoli, 1962 | 7,382- 8,366 | 4 | 9 | 60 | 538,895 | 35.5 |
| | | Okoli,(c) 1962 | 7,218- 7,874 | 12 | 16 | 740 | 830,814 | 80.6 |
| | | Privlaka, 1983 | 2,933- 3,041 | 13 | 17 | 942 | 1,383,584 | 25.9 |
| | | Sandrovac, 1962 | 2,250- 3,700 | 105 | 156 | 4,237 | 37,966,186 | 37.8 |
| | | Števkovica, 1978 | 7,710- 9,843 | 22 | 33 | 883 | 3,842,985 | 31.9 |
| | | Struzec, 1956 | 2,362- 3,773 | 66 | 107 | 5,520 | 101,300,919 | 38.8 |
| | | Vezišće, 1965 | 6,135- 6,562 | 5 | 5 | 19 | 47,989 | 31.6 |
| | | Žutica, 1963 | 5,742- 6,923 | 154 | 194 | 7,696 | 86,049,116 | 33.8 |
| | | Other,(c) | 5,250-11,800 | 10 | 19 | 1,375 | 2,599,630 | 87.9 |
| | NAFTA-GAS | Boka, 1956 | 3,969- 4,100 | 25 | 43 | 544 | 7,815,100 | 32.7 |
| | | Čoka, 1975 | 4,888- 5,046 | 9 | 23 | 205 | 3,665,890 | 44.3 |
| | | Elemir, 1959 | 5,002- 5,376 | 29 | 63 | 520 | 17,377,400 | 32.7 |
| | | Itebej, 1978 | 6,973- 7,327 | 5 | 16 | 43 | 204,290 | 26.4 |
| | | Janošik, 1958 | 2,148- 3,293 | 1 | 4 | 16 | 144,766 | 24.2 |
| | | Jermenovci, 1952 | 2,919- 3,148 | 56 | 100 | 731 | 9,415,246 | 24.2 |
| | | Karadjordjevo, 1973 | 8,308- 8,846 | 6 | 22 | 146 | 1,069,360 | 26.4 |
| | | Kelebija, 1970 | 2,061- 2,788 | 12 | 28 | 546 | 6,461,960 | 21.2 |
| | | Kikinda, 1960 | 3,543- 5,735 | 166 | 229 | 4,632 | 38,380,480 | 34.9 |
| | | Kikinda-varoš, 1963 | 3,740- 6,490 | 50 | 89 | 2,028 | 28,532,000 | 27.9 |
| | | Lokve, 1953 | 2,909- 3,099 | 9 | 26 | 42 | 731,325 | 25.1 |
| | | Morkrin, 1961 | 6,232- 7,216 | 105 | 186 | 2,525 | 19,858,100 | 35.1 |
| | | Mokrin-jug, 1982 | 6,658- 6,740 | 16 | 23 | 556 | 1,011,460 | 41.1 |
| | | Majdan, 1972 | 7,708- 7,790 | 14 | 29 | 270 | 565,300 | 37.4 |
| | | Palić, 1968 | 3,345- 3,427 | 6 | 34 | 55 | 1,668,950 | 45.9 |
| | | V. Greda-jug, 1981 | 3,237- 3,427 | 10 | 22 | 145 | 292,250 | 23.8 |
| | | Velebit, 1965 | 2,434- 2,575 | 122 | 159 | 7,830 | 45,461,540 | 22.8 |
| | | Zrenjanin, 1974 | 6,829- 6,986 | 5 | 11 | 321 | 142,260 | 25.0 |
| | | **Total Yugoslavia** | | 1,671 | 2,728 | 77,178 | 709,768,649 | |
| **ZAIRE** | CHEVRON | • GCO, 1970 | 7,000- 9,000 | 5 | 7 | 169 | 6,394,909 | 38.7 |
| | | • Libwa, 1981 | 5,500 | ... | 2 | ... | ... | 33.0 |
| | | • Lukami, 1983 | 12,400 | 4 | 5 | 1,368 | 7,396,373 | 33.2 |
| | | • Mibale, 1973 | 5,000- 6,000 | 8 | 9 | 10,460 | 89,011,881 | 30.0 |
| | | • Motoba, 1976 | 11,098 | 7 | 7 | 5,439 | 2,152,540 | 31.5 |
| | | • Mwambe, 1979 | 6,150 | 1 | 1 | 143 | 736,610 | 29.7 |
| | ZAIREP (FINA) | East Mibale, 1978 | 6,000 | ... | 1 | ... | 397,600 | 34.0 |
| | | Kifuku, 1983 | 3,400 | 1 | 1 | 16 | 51,000 | 31.0 |
| | | Kinkasi, 1972 | 3,700 | 37 | 42 | 2,411 | 8,182,400 | 31.0 |
| | | Liawenda, 1972 | 3,900 | 29 | 36 | 1,659 | 4,020,500 | 31.0 |
| | | Makelekece, 1983 | 3,600 | 8 | 8 | 388 | 10,357,000 | 31.0 |
| | | Muanda, 1972 | 3,600 | 6 | 7 | 371 | 821,500 | 31.0 |
| | | Nsiamfumu, 1977 | 8,300 | ... | 1 | ... | 5,000 | 34.0 |
| | | Tshiende, 1978 | 6,000 | 4 | 8 | 4,341 | 7,612,900 | 34.0 |
| | | **Total Zaire** | | 110 | 135 | 29,385 | 127,818,913 | |

# Worldwide refining

LOU ANN THRASH
DIRECTOR OF EDITORIAL SURVEYS

All figures in barrels per calendar day

All figures are
as of 1-1-91

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## LEGEND

Numbers identify processes in table

**Thermal processes**
1. Gas oil cracking
2. Thermal cracking
3. Visbreaking
4. Fluid coking
5. Delayed coking
6. Other

**Catalytic cracking**
1. Fluid
2. Other

**Catalytic reforming**
Semiregenerative:
1. Conventional catalyst
2. Bimetallic catalyst

Cyclic:
3. Conventional catalyst
4. Bimetallic catalyst

Other:
5. Conventional catalyst
6. Bimetallic catalyst

**Catalytic hydrocracking**
1. Distillate upgrading
2. Residual upgrading
3. Lube-oil manufacturing
4. Other

**Catalytic hydrorefining**
1. Residual desulfurization
2. Heavy gas oil desulfurization
3. Catalytic cracker and cycle stock feed pretreatment
4. Mid distillate
5. Other

**Catalytic hydrotreating**
1. Pretreating cat reformer feeds
2. Naphtha desulfurizing
3. Naphtha olefin or aromatics saturation
4. Straight-run distillate
5. Other distillates
6. Lube oil "polishing"
7. Other

**Alkylation**
1. Sulfuric acid
2. Hydrofluoric acid

**Aromatics/Isomerization**
1. BTX
2. Hydrodealkylation
3. Cyclohexane
4. $C_4$ feed
5. $C_5$ feed
6. $C_5$ and $C_6$ feed

**Hydrogen**
1. Steam methane reforming
2. Steam naphtha reforming
3. Partial oxidation
4. Cryogenic
5. Other

Calendar-day figures reported in this survey are the average volume a refinery unit processes each day including downtime used for turnarounds. This is actual total volume for the year divided by 365. (Stream day figures represent the amount a unit can process when running full capacity for short periods.)

# Survey of operating refineries worldwide (capacities as of Jan. 1, 1991)

|  |  |  | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | No. plants | Crude, b/cd | Vacuum distillation | Thermal operations | Catalytic cracking | Catalytic reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Abu Dhabi | 2 | 192,500 | 43,600 | .... | .... | 30,100 | 27,000 | .... | 100,500 | .... | .... | .... | .... | 19.0 | .... |
| Algeria | 4 | 464,700 | 15,000 | .... | .... | 55,600 | .... | .... | 23,600 | .... | 1,900 | 2,400 | 5,300 | .... | .... |
| Angola | 1 | 37,630 | 2,635 | .... | .... | 1,714 | .... | .... | 6,677 | .... | .... | .... | 1,318 | .... | .... |
| Argentina | 11 | 696,285 | 288,932 | 164,100 | 171,300 | 41,300 | 23,900 | 20,800 | 63,000 | 6,850 | .... | 5,763 | 21,800 | 19.0 | 1,000 |
| Australia | 10 | 705,500 | 182,000 | .... | 205,200 | 160,900 | .... | 25,500 | 290,800 | 58,900 | 24,700 | 12,260 | 29,200 | .... | .... |
| Austria | 1 | 204,000 | 68,000 | 23,426 | 24,000 | 32,000 | 7,700 | 68,000 | 49,300 | .... | 9,000 | 2,300 | 5,850 | .... | .... |
| Bahrain | 1 | 243,000 | 156,000 | 20,000 | 39,000 | 18,000 | .... | 50,000 | 40,000 | 1,300 | .... | .... | 5,000 | 32.2 | .... |
| Bangladesh | 1 | 31,200 | 3,530 | .... | .... | 1,650 | .... | 2,430 | 1,940 | .... | .... | .... | 1,200 | .... | .... |
| Barbados | 1 | 3,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Belgium | 4 | 602,000 | 298,300 | 63,500 | 104,700 | 81,900 | .... | 153,400 | 182,700 | 7,710 | .... | .... | 25,300 | 46.0 | .... |
| Bolivia | 3 | 45,250 | 2,210 | .... | .... | 11,300 | .... | .... | 11,799 | .... | .... | 285 | 54 | 0.1 | .... |
| Brazil | 13 | 1,411,520 | 725,985 | 39,765 | 316,585 | 23,610 | .... | .... | 155,860 | 3,515 | .... | 23,605 | 68,255 | .... | .... |
| Brunei | 1 | 10,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Cameroon | 1 | 42,000 | .... | .... | .... | 7,000 | .... | 10,500 | 9,500 | .... | .... | .... | .... | .... | .... |
| Canada | 23 | 1,882,060 | 674,945 | 88,978 | 387,870 | 367,060 | 204,803 | 47,300 | 744,745 | 77,445 | 84,202 | 17,360 | 120,200 | 383.2 | 756 |
| Chile | 3 | 145,800 | 67,600 | 19,000 | 37,870 | 10,300 | .... | .... | 5,800 | 800 | .... | .... | 2,100 | .... | .... |
| Colombia | 4 | 247,400 | 130,000 | 60,000 | 91,000 | 6,000 | .... | .... | 34,240 | 5,500 | 5,100 | 2,300 | 2,400 | 21.0 | .... |
| Congo | 1 | 21,000 | 8,000 | .... | .... | 2,000 | 2,000 | .... | 3,500 | .... | .... | .... | .... | .... | .... |
| Costa Rica | 1 | 15,000 | 600 | 6,500 | .... | 1,200 | .... | .... | 2,000 | .... | .... | .... | .... | .... | .... |
| Cyprus | 1 | 18,600 | 2,600 | .... | .... | 4,300 | .... | .... | 7,750 | .... | .... | .... | 1,200 | .... | .... |
| Denmark | 3 | 185,500 | 41,050 | 73,670 | .... | 31,100 | .... | 12,000 | 86,200 | .... | 3,900 | .... | 8,000 | .... | .... |
| Dominican Republic | 2 | 48,000 | .... | .... | .... | 9,100 | .... | .... | 23,200 | .... | .... | .... | .... | 0.8 | .... |
| Ecuador | 5 | 141,800 | 43,020 | 25,200 | 16,000 | 2,780 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Egypt | 8 | 523,153 | 47,000 | 16,470 | .... | 33,540 | .... | 15,000 | 76,878 | 900 | 1,584 | 4,441 | 11,623 | 8.5 | 541 |
| El Salvador | 1 | 16,300 | 1,000 | .... | .... | 3,000 | .... | .... | 13,000 | .... | .... | .... | .... | .... | .... |
| Ethiopia | 1 | 18,000 | 3,000 | .... | .... | 2,400 | .... | .... | 4,500 | .... | .... | .... | 450 | .... | .... |
| Finland | 2 | 241,000 | 81,400 | 46,300 | 41,800 | 42,900 | 14,200 | 104,500 | 57,930 | 7,980 | 3,600 | .... | 11,800 | 20.0 | .... |
| France | 14 | 1,815,630 | 729,910 | 172,990 | 349,480 | 246,760 | 13,440 | 267,040 | 614,540 | 10,150 | 24,960 | 33,400 | 62,580 | 30.0 | .... |
| Gabon | 1 | 24,000 | .... | 7,200 | .... | 1,400 | .... | .... | 5,000 | .... | .... | .... | .... |  |  |
| Germany | 20 | 2,065,400 | 998,100 | 386,962 | 240,250 | 376,500 | 168,200 | 541,200 | 696,110 | 18,150 | 85,630 | 20,800 | 83,200 | 537.4 | 3,505 |
| Ghana | 1 | 26,600 | .... | .... | .... | 6,175 | .... | .... | 6,175 | .... | .... | .... | .... | .... | .... |
| Greece | 4 | 395,300 | 122,600 | 40,400 | 59,900 | 47,000 | 27,900 | 42,800 | 75,900 | 10,806 | 11,200 | .... | 2,800 | 9.6 | .... |
| Guatemala | 1 | 16,000 | .... | .... | .... | 3,000 | .... | ... | 5,000 | .... | .... | .... | .... | .... | .... |
| Honduras | 1 | 14,000 | .... | .... | .... | 1,800 | .... | .... | 5,000 | .... | .... | .... | .... | .... | .... |
| Hungary | 3 | 220,000 | 120,000 | 13,300 | 20,000 | 23,000 | .... | .... | 76,600 | 3,300 | 9,800 | 4,000 | 10,800 | .... | .... |
| India | 12 | 1,122,360 | 365,000 | 114,875 | 136,970 | 28,233 | .... | .... | 99,133 | .... | 8,547 | 13,850 | 45,340 | 95.8 | 930 |
| Indonesia | 6 | 813,600 | 229,000 | 81,700 | 12,600 | 61,500 | 100,100 | 18,000 | 51,500 | 600 | .... | 5,000 | 7,500 | 138.8 | .... |
| Iran | 5 | 720,000 | 284,840 | 92,500 | .... | 105,397 | 93,180 | 20,550 | 105,400 | .... | .... | 10,920 | 30,000 | 186.0 | .... |
| Iraq | 8 | 318,500 | 82,650 | .... | .... | 43,500 | 38,000 | 100,000 | 13,000 | .... | .... | 10,168 | 6,715 | 64.0 | .... |
| Ireland | 1 | 56,000 | .... | .... | .... | 11,000 | .... | 5,500 | 11,000 | .... | .... | .... | .... | .... | .... |
| Israel | 2 | 180,000 | 90,000 | 60,000 | 22,000 | 25,000 | .... | 43,000 | 30,000 | .... | .... | .... | 3,000 | .... | .... |
| Italy | 21 | 2,385,358 | 828,968 | 390,450 | 306,300 | 315,050 | 59,000 | 327,300 | 630,200 | 40,900 | 96,800 | 34,450 | 62,920 | 56.8 | 1,350 |
| Ivory Coast | 2 | 69,000 | 37,500 | .... | .... | 13,600 | 14,200 | 12,800 | 17,200 | .... | .... | .... | 5,000 | .... | .... |
| Jamaica | 1 | 34,200 | 1,900 | .... | .... | 3,240 | .... | .... | 19,350 | .... | .... | .... | .... | .... | .... |
| Japan | 41 | 4,383,400 | 1,721,365 | 76,900 | 629,975 | 607,970 | 113,350 | 1,321,940 | 2,097,325 | 25,836 | 68,800 | 48,875 | 63,675 | 887.3 | 500 |
| Jordan | 1 | 100,000 | 16,500 | .... | 4,250 | 8,640 | 4,800 | .... | 14,850 | .... | .... | .... | 4,000 | 7.9 | .... |
| Kenya | 1 | 90,000 | 1,700 | .... | .... | 9,000 | .... | .... | 33,000 | .... | .... | .... | 900 | .... | .... |
| Korea | 6 | 867,000 | 83,400 | 48,700 | .... | 62,450 | 29,000 | 21,000 | 110,800 | .... | 17,630 | 7,200 | 18,927 | 68.4 | 1,200 |
| Kuwait | 4 | 819,000 | 338,000 | 54,000 | 42,000 | 33,000 | 170,000 | 205,000 | 263,000 | .... | .... | .... | 5,000 | 527.0 | 1,900 |
| Lebanon | 2 | 37,500 | 12,730 | .... | 7,250 | 7,442 | .... | 7,392 | 3,050 | .... | .... | .... | 409 | .... | .... |

# Survey of operating refineries worldwide (capacities as of Jan. 1, 1991)

| | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | No. plants | Crude, b/cd | Vacuum distillation | Thermal operations | Catalytic cracking | Catalytic reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. Poly. | Aromatics-isomerization | Lubes | Asphalt | Hydrogen (MMcfd) | Coke (t/d) |
| Liberia | 1 | 15,000 | 1,000 | .... | .... | 2,000 | .... | .... | 3,300 | .... | .... | .... | 200 | .... | .... |
| Libya | 3 | 347,600 | 3,432 | .... | .... | 13,882 | .... | .... | 36,826 | .... | .... | 635 | 1,716 | .... | .... |
| Madagascar | 1 | 16,350 | 1,200 | 7,000 | .... | 2,600 | .... | 3,600 | 5,500 | .... | .... | .... | .... | .... | .... |
| Malaysia | 4 | 209,500 | 11,750 | .... | .... | 30,300 | .... | .... | 68,540 | .... | .... | .... | 2,000 | .... | .... |
| Martinique | 1 | 12,000 | .... | .... | .... | 3,000 | .... | .... | 8,350 | .... | .... | .... | .... | .... | .... |
| Mexico | 9 | 1,679,000 | 760,700 | 82,000 | 267,000 | 157,800 | 18,000 | 253,000 | 206,000 | 7,450 | 8,220 | 11,500 | 15,000 | 70.0 | 260 |
| Morocco | 2 | 154,600 | 27,400 | .... | 5,600 | 26,800 | .... | .... | 35,800 | .... | .... | 2,100 | 1,900 | .... | .... |
| Myanmar | 2 | 32,000 | 4,000 | 5,200 | .... | .... | .... | .... | .... | .... | .... | 500 | .... | .... | 120 |
| Netherlands | 7 | 1,196,700 | 423,400 | 160,060 | 128,000 | 182,600 | 53,000 | 164,000 | 467,100 | 14,050 | 13,950 | 11,500 | 15,500 | 144.0 | .... |
| Netherlands Antilles | 1 | 320,000 | 158,000 | 67,000 | 42,000 | 15,000 | .... | .... | 125,000 | 5,600 | .... | 8,000 | 63,000 | .... | .... |
| New Zealand | 1 | 95,100 | 41,900 | .... | .... | 26,600 | 23,140 | .... | 60,700 | .... | .... | .... | 800 | 44.0 | .... |
| Nicaragua | 1 | 16,000 | 2,000 | .... | .... | 3,000 | .... | .... | 11,500 | .... | 1,400 | .... | .... | .... | .... |
| Nigeria | 4 | 433,250 | 124,490 | .... | 82,700 | 70,070 | .... | .... | 109,231 | 12,144 | 3,901 | 3,878 | 14,850 | .... | .... |
| Norway | 3 | 288,000 | 4,000 | 68,000 | 41,000 | 47,000 | .... | .... | 108,200 | 11,800 | 3,600 | .... | 4,000 | .... | 469 |
| Oman | 1 | 76,932 | .... | .... | .... | 15,386 | .... | .... | 19,506 | .... | .... | .... | .... | .... | .... |
| Pakistan | 3 | 120,975 | 12,350 | .... | .... | 4,800 | .... | .... | 31,458 | .... | 504 | 3,563 | 3,800 | .... | .... |
| Panama | 1 | 100,000 | 14,000 | .... | .... | 7,500 | .... | .... | 30,000 | .... | .... | .... | 5,000 | .... | .... |
| Paraguay | 1 | 7,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Peru | 6 | 188,820 | 39,150 | .... | 24,600 | 1,760 | .... | .... | .... | .... | .... | 1,200 | 1,200 | .... | .... |
| Philippines | 4 | 279,300 | 67,600 | .... | 26,900 | 37,500 | .... | 23,000 | 86,000 | 4,400 | .... | 3,400 | 10,000 | .... | .... |
| Poland | 9 | 385,454 | 145,582 | .... | 48,705 | 42,186 | .... | 12,000 | 94,158 | 4,353 | 12,535 | 12,933 | 8,000 | .... | .... |
| Portugal | 3 | 294,300 | 53,200 | .... | 10,100 | 51,000 | 9,400 | 28,800 | 74,500 | .... | 6,500 | 3,200 | 6,230 | .... | .... |
| Puerto Rico | 2 | 125,000 | 68,000 | .... | 12,000 | 25,500 | 15,600 | .... | 46,700 | 2,500 | .... | 8,800 | 2,800 | 18.0 | .... |
| Qatar | 1 | 62,000 | .... | .... | .... | 12,030 | .... | 12,000 | 20,500 | .... | .... | .... | .... | .... | .... |
| Saudi Arabia | 8 | 1,862,500 | 425,555 | 71,900 | 87,541 | 183,922 | 76,100 | 44,650 | 478,300 | 15,100 | 43,200 | .... | 24,828 | 218.0 | .... |
| Senegal | 1 | 24,000 | .... | .... | .... | 2,600 | .... | .... | 2,600 | .... | .... | .... | .... | .... | .... |
| Sierra Leone | 1 | 10,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Singapore | 5 | 878,000 | 271,200 | 190,700 | .... | 63,600 | 71,000 | 91,600 | 261,600 | .... | .... | 13,900 | 12,600 | 81.6 | .... |
| Somalia | 1 | 10,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| South Africa | 4 | 430,500 | 102,000 | 72,000 | 84,400 | 62,600 | 20,000 | 77,300 | 141,850 | 5,200 | 6,000 | 3,000 | 5,140 | 27.5 | .... |
| Spain | 10 | 1,321,000 | 393,200 | 179,500 | 157,300 | 191,000 | 15,000 | 75,000 | 210,100 | .... | 23,820 | 7,700 | 67,205 | 43.0 | 1,250 |
| Sri Lanka | 1 | 50,000 | 2,400 | 12,500 | .... | 3,750 | .... | 2,100 | 15,300 | .... | .... | .... | 1,000 | .... | .... |
| Sudan | 1 | 21,700 | .... | .... | .... | 1,900 | .... | .... | 8,100 | .... | .... | .... | .... | .... | .... |
| Sweden | 5 | 427,500 | 135,000 | 65,000 | 25,000 | 72,000 | .... | 65,000 | 154,500 | 3,500 | 16,000 | 2,500 | 28,500 | 1.9 | .... |
| Switzerland | 2 | 132,000 | 24,000 | 20,000 | .... | 26,000 | .... | 8,000 | 49,200 | .... | 3,600 | .... | 5,200 | .... | .... |
| Syria | 2 | 237,394 | 57,245 | 37,285 | .... | 31,352 | .... | 61,615 | 42,132 | .... | 2,850 | .... | 4,474 | 21.8 | 530 |
| Taiwan | 2 | 542,500 | 111,700 | 17,493 | 22,600 | 51,960 | 18,080 | 149,160 | 78,930 | 3,325 | 14,938 | .... | 10,995 | 192.0 | 1,050 |
| Tanzania | 1 | 17,000 | .... | .... | .... | 6,700 | .... | .... | 5,000 | .... | .... | .... | .... | .... | .... |
| Thailand | 3 | 220,550 | 58,900 | 17,600 | 26,100 | 27,550 | .... | 12,550 | 100,800 | .... | .... | .... | 4,100 | 37.3 | .... |
| Trinidad | 2 | 246,000 | 130,000 | 8,000 | 26,000 | 14,400 | .... | 4,000 | 46,100 | 2,500 | 1,700 | 2,700 | .... | .... | .... |
| Tunisia | 1 | 34,000 | .... | .... | .... | 3,300 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Turkey | 5 | 728,644 | 156,358 | 4,177 | 40,575 | 66,557 | .... | 15,096 | 150,515 | .... | .... | 4,000 | 29,117 | 0.4 | .... |
| United Kingdom | 15 | 1,866,940 | 843,990 | 146,000 | 444,500 | 366,300 | 54,000 | 115,600 | 846,090 | 102,600 | 74,650 | 21,600 | 57,400 | 98.2 | 2,150 |
| Uruguay | 1 | 33,000 | 13,000 | .... | 4,100 | 2,500 | .... | .... | 3,700 | .... | .... | .... | .... | .... | .... |
| Venezuela | 6 | 1,167,000 | 548,370 | 134,100 | 139,000 | 6,000 | .... | 277,700 | 700 | 62,800 | 24,300 | 8,100 | 40,000 | 105.0 | 100 |
| Virgin Islands | 1 | 545,000 | 215,000 | 80,000 | .... | 125,000 | .... | 130,000 | 290,000 | .... | 45,000 | .... | .... | .... | .... |
| Yemen | 2 | 171,500 | 9,500 | .... | .... | 13,300 | .... | 2,700 | .... | .... | .... | .... | 2,000 | .... | .... |
| Yugoslavia | 7 | 609,135 | 178,759 | 35,630 | 52,050 | 74,612 | 7,200 | 21,970 | 107,878 | 3,400 | 17,335 | 4,900 | 23,610 | 14.9 | 137 |
| Zaire | 1 | 17,000 | .... | .... | .... | 3,500 | .... | .... | 5,000 | .... | .... | .... | .... | .... | .... |
| Zambia | 1 | 24,500 | 2,400 | .... | .... | 5,600 | .... | .... | 9,000 | .... | .... | .... | .... | .... | .... |
| **Total** | **432** | **42,847,790** | **14,592,301** | **3,598,821** | **5,064,171** | **5,205,728** | **1,481,290** | **5,093,393** | **11,634,816** | **541,364** | **780,356** | **398,986** | **1,205,981** | **4,276.35** | **17,748** |

| | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. °Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **ABU DHABI** | Abu Dhabi National Oil Co.–Ruwais | 120,000 | 43,600 | .... | .... | [2]19,200 | [1]27,000 | .... | [2]34,400<br>[4]20,800<br>[5]21,900<br>[2]17,500 | .... | .... | .... | .... | [1]19.0 | .... |
| | Umm Al-Nar 2 | 72,500 | .... | .... | .... | [4]10,900 | .... | .... | [4]5,900 | .... | .... | .... | .... | .... | .... |
| | **Total** | **192,500** | **43,600** | **....** | **....** | **30,100** | **27,000** | **....** | **100,500** | **....** | **....** | **....** | **....** | **19.0** | **....** |
| **ALBANIA** | Government-owned refineries at Ballsh, Cerrik, Stalin. | | | | | | | | | | | | | | |
| | **Total** | **40,000** | | | | | | | | | | | | | |
| **ALGERIA** | Sonatrach: Arzew | 60,000 | 6,000 | .... | .... | 8,600 | .... | .... | 8,600 | .... | .... | 2,400 | 2,400 | .... | .... |
| | Hassi Messaoud | 23,700 | .... | .... | .... | 2,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Maison Carree | 58,000 | .... | .... | .... | 15,000 | .... | .... | 15,000 | .... | .... | .... | .... | .... | .... |
| | Skikda | 323,000 | 9,000 | .... | .... | 30,000 | .... | .... | .... | .... | 1,900 | .... | 2,900 | .... | .... |
| | **Total** | **464,700** | **15,000** | **....** | **....** | **55,600** | **....** | **....** | **23,600** | **....** | **1,900** | **2,400** | **5,300** | **....** | **....** |
| **ANGOLA** | Fina Petroleos De Angola–Luanda | 37,630 | 2,635 | .... | .... | [1]1,714 | .... | .... | [2]3,426<br>[4]3,251 | .... | .... | .... | 1,318 | .... | .... |
| | **Total** | **37,630** | **2,635** | **....** | **....** | **1,714** | **....** | **....** | **6,677** | **....** | **....** | **....** | **1,318** | **....** | **....** |
| **ARGENTINA** | Destileria Argentina de Petróleo SA–Lomas de Zamora | 3,585 | 1,132 | .... | .... | .... | .... | .... | .... | .... | .... | 113 | .... | .... | .... |
| | Esso SAPA–Campana[1] | 93,000 | 51,300 | [5]24,200 | [1]29,600 | [2]8,300 | .... | .... | [2]5,800<br>[5]10,000 | .... | .... | .... | .... | .... | 1,000 |
| | Galvan | 18,400 | .... | [2]7,700 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Isaura SA–Bahia Blanca | 12,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Shell Cia. Argentina de Petróleo SA–Buenos Aires | 121,700 | 54,000 | [3]27,000 | [1]29,200 | [1]12,000 | .... | .... | [2]14,900<br>[4]7,500 | [2]1,700<br>°500 | .... | 1,500 | 4,200 | .... | .... |
| | Sol Petroleo SA–San Francisco Solana, Quilmes | 6,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Yacimientos Petroliferos Fiscales–Campo Duran | 32,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Dock Sud | 4,000 | 1,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | La Plata | 216,000 | 99,400 | [5]39,900 | [1]71,900 | [1]9,000 | .... | [1]9,000 | [1]9,000<br>[4]3,000<br>[6]5,900 | [1]1,200<br>[2]750<br>°2,700 | .... | 4,150 | 17,600 | .... | .... |
| | Lujan de Cuyo | 129,000 | 66,000 | [5]49,300 | [1]40,600 | [1]9,000 | [1]23,900 | [4]11,800 | [1]4,400 | .... | .... | .... | .... | [1]19.0 | .... |
| | Plaza Huincul | 23,000 | .... | .... | .... | [1]3,000 | .... | .... | [2]2,500 | .... | .... | .... | .... | .... | .... |
| | San Lorenzo | 37,600 | 16,100 | [2]3,500<br>[3]12,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **696,285** | **288,932** | **164,100** | **171,300** | **41,300** | **23,900** | **20,800** | **63,000** | **6,850** | **....** | **5,763** | **21,800** | **19.0** | **1,000** |
| | Solvent Extract: [1]3,600 b/cd | | | | | | | | | | | | | | |
| **AUSTRALIA** | Ampol Refineries Ltd.–Lytton | 72,000 | .... | .... | [1]28,000 | [1]15,000 | .... | .... | [5]5,400 | [1]4,000<br>°1,500 | [6]8,200 | .... | .... | .... | .... |
| | Australian Lubricating Oil Refinery Ltd.–Kurnell[1] | .... | 6,900 | .... | .... | .... | .... | .... | [6]7,000 | .... | .... | 3,000 | .... | .... | .... |
| | BP Australia–Brisbane | 57,000 | 15,600 | .... | [1]17,300 | [2]12,200 | .... | .... | [1]12,200<br>[4]9,000 | [2]2,100 | .... | .... | 8,400 | .... | .... |

| | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| | Kwinana | 118,000 | 19,000 | .... | ¹28,000 | ²14,000 | .... | .... | ¹14,000<br>⁵4,400<br>⁶4,400 | ²2,700<br>*2,100 | .... | 2,060 | 500 | .... | .... |
| | Caltex Refining CPL–Kurnell | 100,000 | 16,000 | .... | ¹44,000 | ²24,000 | .... | .... | ¹24,000<br>⁴⁻⁵14,400 | ¹3,400<br>*2,700 | .... | .... | 5,000 | .... | .... |
| | Mobil Oil Australia Ltd.–Adelaide | .... | 20,000 | .... | .... | .... | .... | .... | .... | .... | ⁶9,500 | 4,700 | .... | .... | .... |
| | Petroleum Refineries Australia PL– Adelaide | 65,500 | ... | .... | .... | ²20,000 | .... | .... | ¹42,500 | .... | .... | .... | 4,500 | .... | .... |
| | Altona | 108,000 | 73,800 | .... | ²28,000 | ¹31,000 | .... | .... | ¹48,000<br>⁴13,500 | ¹2,600 | .... | .... | 4,800 | .... | .... |
| | Shell Refining (Australia) PL.–Clyde | 75,000 | 21,000 | .... | ¹35,000 | ²13,700 | .... | ²7,000 | ⁴37,000 | ²3,000<br>*800 | .... | .... | 3,000 | .... | .... |
| | Geelong | 110,000 | 9,700 | .... | ¹25,000 | ²11,000<br>⁶20,000 | .... | ²4,000<br>³11,000<br>⁵3,500 | ⁴55,000 | ²33,000<br>*1,000 | ⁶7,000 | 2,500 | 3,000 | .... | .... |
| | **Total** | **705,500** | **182,000** | .... | **205,300** | **160,900** | .... | **25,500** | **290,800** | **58,900** | **24,700** | **12,260** | **29,200** | .... | .... |
| | Solvent Extract: ¹6,400 b/cd | | | | | | | | | | | | | | |
| **AUSTRIA** | OeMV–Schwechat | 204,000 | 68,000 | ³17,000<br>⁶6,426 | ¹24,000 | ²14,000<br>⁴18,000 | ⁴7,700 | ³35,000<br>⁴33,000 | ¹37,000<br>⁶1,300<br>⁷11,000 | .... | ⁶9,000 | 2,300 | 5,850 | .... | .... |
| | **Total** | **204,000** | **68,000** | **23,426** | **24,000** | **32,000** | **7,700** | **66,000** | **49,300** | .... | **9,000** | **2,300** | **5,850** | .... | .... |
| **BAHRAIN** | Bahrain Petroleum Co. BSC (Closed)–Sitra | 243,000 | 156,000 | ³20,000 | ¹39,000 | ²18,000 | .... | ¹50,000 | ¹18,000<br>⁴22,000 | *1,300 | .... | .... | 5,000 | ¹32.2 | .... |
| | **Total** | **243,000** | **156,000** | **20,000** | **39,000** | **18,000** | .... | **50,000** | **40,000** | **1,300** | .... | .... | **5,000** | **32.2** | .... |
| **BANGLADESH** | Eastern Refinery Ltd.–Chittagong | 31,200 | 3,530 | .... | .... | ¹1,650 | .... | ⁴2,430 | ¹1,940 | .... | .... | .... | 1,200 | .... | .... |
| **BARBADOS** | Mobil Oil Barbados Ltd.–Bridgetown | 3,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **BELGIUM** | Belgian Refining Corp. NV–Antwerp | 80,000 | 45,000 | ³21,000 | .... | ³12,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Esso Belgium–Antwerp | 239,000 | 108,600 | .... | ¹28,200 | ⁴39,200 | .... | ²90,000 | ²44,400<br>⁴71,200 | .... | .... | .... | 2,000 | ¹46.0 | .... |
| | Nynas Petroleum NV—Antwerp | 15,000 | 12,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 12,000 | .... | .... |
| | Fina Raffinaderij Antwerpen—Antwerp | 268,000 | 132,200 | ³42,500 | ¹76,500 | ²30,200 | .... | ³⁻⁴63,400 | ²67,100 | ²6,150<br>*1,560 | .... | .... | 11,300 | .... | .... |
| | **Total** | **602,000** | **298,300** | **63,500** | **104,700** | **81,900** | .... | **153,400** | **182,700** | **7,710** | .... | .... | **25,300** | **46.0** | .... |
| **BOLIVIA** | Yacimientos Petroliferos Fiscales Bolivianos– Cochabamba¹ | 27,250 | 2,210 | .... | .... | ²4,900 | .... | .... | ¹4,900<br>⁶499 | .... | .... | 285 | 54 | ⁵0.1 | .... |
| | Santa Cruz | 15,000 | .... | .... | .... | ²6,400 | .... | .... | ¹6,400 | .... | .... | .... | .... | .... | .... |
| | Sucre | 3,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **45,250** | **2,210** | .... | .... | **11,300** | .... | .... | **11,799** | .... | .... | **285** | **54** | **0.1** | .... |

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[1] Solvent extraction: 168 b/cd.

| | | Company and refinery location | Charge capacity, b/cd | | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **BRAZIL** | | Petróleo Brasileiro SA: Araucária, Paraná[1] | 144,800 | 66,300 | .... | [1]42,300 | .... | .... | .... | .... | .... | .... | .... | 27,455 | .... | .... |
| | | Betim, Minas Gerais | 144,700 | 72,300 | .... | [1]32,100 | .... | .... | .... | [2]10,200<br>[5]25,000 | .... | .... | .... | .... | .... | .... |
| | | Canoas, Rio Grande do Sul | 72,400 | 35,000 | .... | [1]13,700 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | Capuava, São Paulo | 30,200 | 10,200 | .... | [2]17,300 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | Cubatão, São Paulo | 155,325 | 71,725 | [5]31,065 | [1]50,600 | [1]10,500 | .... | .... | .... | [2]3,515 | .... | .... | .... | .... | .... |
| | | Duque de Caxias, Rio de Janeiro[2] | 209,190 | 114,760 | .... | [1]35,815 | [1]13,110 | .... | .... | [6-7]32,870 | .... | .... | 17,005 | 31,635 | .... | .... |
| | | Fortaleza, Ceará | .... | 4,465 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4,465 | .... | .... |
| | | Manaus, Amazonas | 8,500 | 5,400 | .... | [1]1,900 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | Mataripe, Bahia[3] | 113,525 | 74,385 | .... | [1]25,000 | .... | .... | .... | [6]3,400<br>[7]2,500 | .... | .... | 6,600 | 4,700 | .... | .... |
| | | Paulínia, São Paulo | 289,500 | 144,800 | .... | [1]41,600 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | São José dos Campos, São Paulo | 215,080 | 122,500 | .... | [1]53,770 | .... | .... | .... | [2-4]81,890 | .... | .... | .... | .... | .... | .... |
| | | Refinaria de Petróleo Ipiranga SA–Rio Grande do Sul | 9,300 | 4,100 | .... | [1]2,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | Refinaría de Petroleos de Manguinhos SA–Rio de Janeiro | 10,000 | .... | [2]4,300<br>[3]4,400 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | **Total** | **1,411,520** | **725,985** | **39,765** | **316,585** | **23,610** | **....** | **....** | **155,860** | **3,515** | **....** | **23,605** | **68,255** | **....** | **....** |

[1]Solvent extraction: 27,800 b/cd. [2]30,200 b/cd. [3]3,400 b/cd.

| | | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BRUNEI** | | Brunei Shell Petroleum CL–Seria | 10,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **BULGARIA** | | Government-owned refineries at Burgas, Pleven, Ruse. | | | | | | | | | | | | | | |
| | | **Total** | **300,000** | | | | | | | | | | | | | |
| **CAMEROON** | | Sonara–National Refining CL–Cape Limboh, Limbe | 42,000 | .... | .... | .... | [2]7,000 | .... | [5]10,500 | [1]9,500 | .... | .... | .... | .... | .... | .... |
| **CANADA** | **Alberta** | Husky Oil Operations Ltd.–Lloydminster | 23,500 | 15,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 12,000 | .... | .... |
| | | Imperial Oil Ltd.–Edmonton | 164,900 | 66,100 | .... | [1]47,000 | [4]20,900 | .... | [4]15,000 | [2]51,000 | [2]12,200 | [4]6,700 | 3,200 | 5,800 | .... | .... |
| | | Parkland Refining Ltd.–Bowden | 6,700 | .... | .... | .... | [1]3,000 | .... | .... | [1]3,000<br>[2]3,000 | .... | [6]3,000 | .... | .... | .... | .... |
| | | Petro-Canada Products Inc.–Edmonton | 115,500 | 27,000 | [5]7,100 | [1]33,300 | [2]9,000 | [4]18,200 | .... | [5]7,300<br>[7]46,600 | [2]9,500 | [4]3,000<br>[6]9,100 | .... | .... | [1]30.8 | 431 |
| | | Shell Canada Ltd.–Scotford | 56,810 | .... | .... | .... | [6]20,425 | [1]38,475 | .... | [2]20,425<br>[4]19,950 | .... | [1-2]5,300<br>[3]270 | .... | .... | [1]62.0 | .... |
| | | Turbo Resources Ltd.–Balzac | 27,500 | 6,950 | .... | [1]11,570 | [2]7,550 | .... | .... | [2]10,410<br>[4]7,550<br>[7]13,300 | *1,035 | [6]2,882 | .... | .... | .... | .... |
| | | **Total** | **394,910** | **115,050** | **7,100** | **91,870** | **60,875** | **56,675** | **15,000** | **182,535** | **22,735** | **30,252** | **3,200** | **17,800** | **92.8** | **431** |
| | **British Columbia** | Chevron Canada Ltd.–North Burnaby | 45,000 | 9,400 | .... | [1]10,500 | [2]10,000 | .... | .... | [1]10,000 | [1]2,000<br>*600 | .... | .... | 2,500 | .... | .... |

| | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. •Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| | Husky Oil Operations Ltd.– Prince George | 9,500 | 3,800 | .... | [1]3,300 | [2]1,400 | .... | .... | [5]6,900 | .... | .... | .... | 1,300 | .... | .... |
| | Imperial Oil Ltd.–Ioco | 42,800 | 24.100 | .... | [1]12,300 | [4]7,000 | .... | .... | [2]7,000<br>[4]5,200<br>[5]5,200 | •1,800 | .... | .... | 700 | .... | .... |
| | Petro-Canada Products Inc.– Port Moody | 25,500 | .... | .... | .... | [2]8,600 | .... | .... | [1]15,400<br>[4]14,100 | .... | .... | .... | .... | .... | .... |
| | Taylor | 15,500 | 1,600 | .... | [1]6,300 | [2]3,000 | .... | .... | [1]4,000<br>[4]7,200 | [2]1,000 | .... | .... | 500 | .... | .... |
| | Shell Canada Ltd.– Shellburn, Burnaby | 22,800 | 6,650 | .... | [1]5,320 | [2]3,420 | .... | .... | [2]5,130<br>[4]9,405 | •720 | .... | .... | 2,900 | .... | .... |
| | **Total** | **161,100** | **45,550** | .... | **37,720** | **33,420** | .... | .... | **89,535** | **6,120** | .... | .... | **7,900** | .... | .... |
| **New Brunswick** | Irving Oil Ltd.–St. John | 237,500 | 61,750 | [3]18,000 | [1]17,100 | [2]34,650 | [1]29,700 | .... | [1]45,450<br>[4]40,500 | [1]5,000<br>•1,710 | [6]9,500 | .... | 11,700 | [2]40.0 | .... |
| | **Total** | **237,500** | **61,750** | **18,000** | **17,100** | **34,650** | **29,700** | .... | **85,950** | **6,710** | **9,500** | .... | **11,700** | **40.0** | .... |
| **Newfoundland** | Newfoundland Processing Ltd.– Come By Chance | **105,000** | **56,000** | .... | .... | [2]**26,000** | [1]**35,000** | .... | .... | .... | .... | .... | .... | **66.0** | .... |
| **Northwest Territories** | Imperial Oil Ltd.–Norman Wells | **3,500** | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **Nova Scotia** | Imperial Oil Ltd.–Dartmouth | 82,300 | 39,800 | .... | [1]23,000 | [4]9,500 | .... | .... | [1]9,500<br>[4]25,700<br>[5]8,600 | •2,600 | .... | .... | 4,200 | [1]1.7 | .... |
| | McColl Frontenac Inc.–Halifax | 20,000 | 8,600 | .... | [1]7,200' | [2]3,600 | .... | [4]5,200 | [1]3,600 | .... | .... | .... | .... | .... | .... |
| | **Total** | **102,300** | **48,400** | .... | **30,200** | **13,100** | .... | **5,200** | **47,400** | **2,600** | .... | .... | **4,200** | **1.7** | .... |
| **Ontario** | Imperial Oil Ltd.–Nanticoke | 106,400 | 30,200 | .... | [1]37,600 | [6]24,700 | .... | .... | [1]25,700 | [1]7,100 | .... | .... | .... | .... | .... |
| | Sarnia | 122.600 | 28,500 | [4]21,000 | [1]25,000 | [2]13,300<br>[4]14,300 | [1]10,400 | .... | [2]32,300<br>[4]13,300<br>[5]24,700 | [2]6,800<br>•4,200 | .... | 6,200 | .... | [1]21.8 | .... |
| | Petro-Canada Products Inc.– Clarkson | 41,500 | 35,500 | .... | .... | [6]9,800 | [3]10,300 | .... | [1]10,300<br>[4]5,900 | .... | .... | 4,900 | 4,600 | [1]13.3 | .... |
| | Oakville | 80,500 | 41,000 | .... | [1]25,400 | [2]13,200 | .... | .... | [1]19,500<br>[4]6,300 | [1]3,100 | .... | .... | 9,500 | .... | .... |
| | Shell Canada Ltd.–Sarnia | 67,450 | 23,465 | [3]3,878 | [1]13,680 | [2]19,950 | [1]6,413 | .... | [1]14,250<br>[5]5,985 | •1,600 | [1]2,700 | .... | .... | .... | .... |
| | Suncor Inc.–Sarnia | 83,000 | 16,600 | [3]6,700 | [2]16,300 | [2]26,700 | [1]20,000 | .... | [1]24,900<br>[4]4,800 | [2]5,100 | [1]10,250 | .... | 2,500 | [1]46.0 | .... |
| | **Total** | **501,450** | **175,265** | **31,578** | **117,980** | **121,950** | **47,113** | .... | **187,935** | **27,900** | **12,950** | **11,100** | **16,600** | **81.1** | .... |
| **Quebec** | Petro-Canada Products Inc.– Montreal | 87,400 | 40,700 | [3]12,600 | [1]17,200 | [2]31,300 | [4]14,400 | .... | [1]26,600<br>[4]9,000 | [1]2,300<br>•800 | [1]8,700<br>[2]2,800 | .... | 14,300 | [1]42.8 | .... |
| | Shell Canada Ltd.–Montreal | 114,000 | 46,930 | [3]11,400 | [1]20,900 | [2]19,865 | [1]11,115 | .... | [2]32,490<br>[4]25,650 | [2]2,500 | [6]6,800 | 3,060 | 7,200 | .... | .... |

| | Company and refinery location | Crude | Charge capacity, b/cd<br>Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/cd<br>Alky. *Poly. | Aromatics/isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ultramar Canada Inc.–St. Romuald | 116,400 | 55,000 | .... | [1]37,300 | [2]17,100 | .... | .... | [1]23,350<br>[4]14,500 | *3,900 | [6]10,500 | .... | 35,000 | .... | .... |
| | **Total** | **317,800** | **142,630** | **24,000** | **75,400** | **68,065** | **25,515** | **....** | **131,590** | **9,500** | **28,800** | **3,060** | **56,500** | **42.8** | **....** |
| **Saskatchewan** | Consumers' Cooperative Refineries Ltd.–Regina | 45,200 | 23,000 | [5]8,300 | [1]17,600 | [2]9,000 | 10,800 | [1]27,100 | [1]10,800<br>[2]2,700<br>[5]6,300 | *1,880 | [6]2,700 | .... | .... | [1]58.8 | 325 |
| | Producers Pipeline–Moose Jaw | 13,300 | 7,300 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 5,500 | .... | .... |
| | **Total** | **58,500** | **30,300** | **8,300** | **17,600** | **9,000** | **10,800** | **27,100** | **19,800** | **1,880** | **2,700** | **....** | **5,500** | **58.8** | **325** |
| | **Total Canada** | **1,882,060** | **674,945** | **88,978** | **387,870** | **367,060** | **204,803** | **47,300** | **744,745** | **77,445** | **84,202** | **17,360** | **120,200** | **383.2** | **756** |
| **CHILE** | ENAP–Gregorio-Magallanes | 8,800 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Petrox SA–Talcahuano | 72,000 | 35,600 | [3]10,000 | [1]18,870 | [2]4,500 | .... | .... | .... | .... | .... | .... | 100 | .... | .... |
| | Refinería de Concón–Concón | 65,000 | 32,000 | [3]9,000 | [1]19,000 | [2]5,800 | .... | .... | [2]5,800 | [1]800 | .... | .... | 2,000 | .... | .... |
| | **Total** | **145,800** | **67,600** | **19,000** | **37,870** | **10,300** | **....** | **....** | **5,800** | **800** | **....** | **....** | **2,100** | **....** | **....** |
| **CHINA** | Government-owned refineries at Anshan, Beijing, Dalian, Daqing, Fushun, Hangzhou, Jinxi, Karamai-Dushanzi, Lanchow, Lenghu, Maoming, Nanchong, Nanjing, Shanghai, Shengli, Tianjin, Yumen. | | | | | | | | | | | | | | |
| | **Total** | **2,200,000** | | | | | | | | | | | | | |
| **COLOMBIA** | Empresa Colombiana de Petróleos –Barrancabermeja-Santander[1] | 170,000 | 90,000 | [3]40,000 | [1]62,000 | [2]6,000 | .... | .... | [1]6,000<br>[3]540<br>[5]22,000<br>[6]4,300<br>[7]1,400 | [1]3,000<br>[2]500<br>[4]2,000 | [1]3,300<br>[2]1,100<br>[3]700 | 2,300 | 2,400 | [1]21.0 | .... |
| | Cartagena, Bolivar | 70,000 | 40,000 | [3]20,000 | [1]29,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Orito, Putumayo | 2,400 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Tibu, N. de Santander | 5,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **247,400** | **130,000** | **60,000** | **91,000** | **6,000** | **....** | **....** | **34,240** | **5,500** | **5,100** | **2,300** | **2,400** | **21.0** | **....** |
| | Solvent extraction: [1]35,000 b/cd. | | | | | | | | | | | | | | |
| **CONGO** | Coraf–Pointe-Noire | 21,000 | 8,000 | .... | .... | [2]2,000 | [1]2,000 | .... | [4]3,500 | .... | .... | .... | .... | .... | .... |
| **COSTA RICA** | Refinadora Costarricense de Petroleo SA–Limón | 15,000 | 600 | [2]6,500 | .... | [2]1,200 | .... | .... | [4]2,000 | .... | .... | .... | .... | .... | .... |
| **CUBA** | Government-owned refineries at Cabaiguan, Cienfuegos, Havana, Santiago de Cuba. | | | | | | | | | | | | | | |
| | **Total** | **280,000** | | | | | | | | | | | | | |
| **CYPRUS** | Cyprus Petroleum Refinery Ltd.–Larnaca | 18,600 | 2,600 | .... | .... | [2]4,300 | .... | .... | [4]7,750 | .... | .... | .... | 1,200 | .... | .... |
| **CZECHO-SLOVAKIA** | Government owned refineries at Kolin, Pardubice, Strazke, Zaluzi, Zyolen. | | | | | | | | | | | | | | |
| | Crude capacity | 240,200 | | | | | | | | | | | | | |
| | Kaucuk s.p.–Kralupy | 64,800 | .... | .... | .... | [2]7,500 | .... | ....<br>[4]6,400<br>[5]16,000 | [2]14,500 | .... | .... | .... | .... | .... | .... |

| WORLDWIDE REFINING | Company and refinery location | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
| | Slovnaft s.p.–Bratislava[1] | 150,000 | 10,000 | .... | .... | [2]22,700 | .... | [4]65,500 | [1]22,700<br>[3]4,500<br>[6]4,200 | .... | [1]4,000<br>[2]1,050 | 4,160 | 19,300 | [5]20.9 | .... |
| | **Total** | **455,000** | **10,000** | **....** | **....** | **30,200** | **....** | **65,500** | **68,300** | **....** | **5,050** | **4,160** | **19,300** | **20.9** | **....** |
| | Solvent extraction: [1]700 b/cd. | | | | | | | | | | | | | | |
| **DENMARK** | AS Dansk Shell–Fredericia | 62,000 | .... | [2]25,000 | .... | [2]12,000 | .... | [2]12,000 | [2]21,000 | .... | [6]3,900 | .... | .... | .... | .... |
| | Statoil AS–Kalundborg | 65,000 | 22,000 | [3]28,000 | .... | [2]8,600 | .... | .... | [1]8,600<br>[5]11,400 | .... | .... | .... | 8,000 | .... | .... |
| | Kuwait Petroleum Refining (Danmark) A/S–Skaelskoer | 58,500 | 19,050 | [2]10,900<br>[3]9,770 | .... | [2]10,500 | .... | .... | [2]22,300<br>[4-5]22,900 | .... | .... | .... | .... | .... | .... |
| | **Total** | **185,500** | **41,050** | **73,670** | **....** | **31,100** | **....** | **12,000** | **86,200** | **....** | **3,900** | **....** | **8,000** | **....** | **....** |
| **DOMINICAN REPUBLIC** | Falconbridge Dominicana C por A–La Bonao | 16,000 | .... | .... | .... | .... | .... | .... | [2]6,200 | .... | .... | .... | .... | [2]0.8 | .... |
| | Refineria Dominicana de Petróleo SA–Haina | 32,000 | .... | .... | .... | [1]9,100 | .... | .... | [4]17,000 | .... | .... | .... | .... | .... | .... |
| | **Total** | **48,000** | **....** | **....** | **....** | **9,100** | **....** | **....** | **23,200** | **....** | **....** | **....** | **....** | **0.8** | **....** |
| **ECUADOR** | CEPE–Esmeraldas | 90,000 | 43,020 | [3]25,200 | [1]16,000 | [2]2,780 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Sta. Elena Peninsula | 32,300 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Refieria Amazonas | 10,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Repetrol–Santa Elena | 8,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Texaco–Lago-Agrio | 1,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **141,800** | **43,020** | **25,200** | **16,000** | **2,780** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** |
| **EGYPT** | Alexandria Petroleum Co.–Alexandria–(El-Mex) | 97,850 | 22,500 | .... | .... | .... | .... | .... | [6]1,436<br>[7]76 | .... | 603<br>281 | 1,436 | 2,010 | [1]1.0 | 1 |
| | Cairo Oil Refining Co.–Mostorod | 156,750 | .... | .... | .... | [2]9,000 | .... | .... | [1]11,700<br>[4]14,400 | .... | .... | .... | .... | .... | .... |
| | Tanta | 21,800 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Amerya Oil Refining Co.–Alexandria | 64,000 | 15,000 | .... | .... | [2]12,000 | .... | [2]8,000<br>[4]7,000 | [2]14,000<br>[4]4,000<br>[6]1,800<br>[7]700 | [2]900 | [1]700 | 2,000 | 7,000 | [2]4.0 | .... |
| | El-Nasr Petroleum Co.–El-Suez | 58,400 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2,613 | .... | .... |
| | Wadi-Feran | 9,680 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Suez Oil Processing Co.–El-Suez | 62,530 | 9,500 | [5]16,470 | .... | [2]12,540 | .... | .... | [1]16,660<br>[4]10,800<br>[6]1,306 | .... | .... | 1,005 | .... | [5]3.5 | 540 |
| | Assiout | 52,143 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **523,153** | **47,000** | **16,470** | **....** | **33,540** | **....** | **15,000** | **76,878** | **900** | **1,584** | **4,441** | **11,623** | **8.5** | **541** |
| **El SALVADOR** | Refineria Petrólera Acajutla SA–Acajutla | 16,300 | 1,000 | .... | .... | [1]3,000 | .... | .... | [2]6,000<br>[4]7,000 | .... | .... | .... | .... | .... | .... |
| | **Total** | **16,300** | **1,000** | **....** | **....** | **3,000** | **....** | **....** | **13,000** | **....** | **....** | **....** | **....** | **....** | **....** |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **ETHIOPIA** | Ethiopian Petroleum Corp.–Assab | **18,000** | **3,000** | .... | .... | **[3]2,400** | .... | .... | **[4]4,500** | .... | .... | .... | **450** | .... | .... |
| **FINLAND** | Neste Oy–Naantali | 44,000 | 13,700 | [3]7,100 | [2]13,300 | [5]6,800 | .... | [3]7,100<br>[4]14,700 | [2]6,600<br>[7]330 | *280 | .... | .... | 3,000 | .... | .... |
|  | Porvoo | 197,000 | 67,700 | [3]39,200 | [1]28,500 | [5]36,100 | [1]14,200 | [4]82,700 | [2]51,000 | [2]4,200<br>*3,500 | [5]3,600 | .... | 8,800 | [1]20.0 | .... |
|  | **Total** | **241,000** | **81,400** | **46,300** | **41,800** | **42,900** | **14,200** | **104,500** | **57,930** | **7,960** | **3,600** | .... | **11,800** | **20.0** | .... |
| **FRANCE** | CRD—Total France–Gonfreville L'Orcher[1] | 309,000 | 73,000 | [3]16,600 | [1]31,500 | [2]45,400 | .... | [3]59,600<br>[5]9,000 | [1]27,100<br>[2]71,600 | *1,150 | [1]1,360 | 7,400 | 20,250 | .... | .... |
|  | La Mède | 136,000 | 47,500 | [3]20,850 | [1]29,700 | [4]23,400 | .... | [3]49,100<br>[5]10,400 | .... | [2]2,400 | .... | .... | 16,200 | .... | .... |
|  | Mardyck | 122,000 | 41,600 | .... | [1]29,800 | [4]20 500 | .... | [3]24,500 | [2]37,500 | .... | .... | .... | .... | .... | .... |
|  | Cie. Rhénane de Raffinage–Reichstett-Vendenheim | 80,000 | 35,600 | [2]5,280<br>[3]11,440 | [1]13,760 | [1]12,900 | .... | [2]17,200 | [2]24,940 | .... | .... | .... | 7,930 | .... | .... |
|  | Elf France–Donges | 200,000 | 99,000 | [3]30,800 | [1]66,000 | [2]25,600 | .... | .... | [1]35,600<br>[4]39,600 | [2]3,700 | [6]6,300 | .... | .... | .... | .... |
|  | Feyzin | 120,000 | 36,000 | [3]15,900 | [1]22,700 | [2]8,600 | .... | .... | [1]8,700<br>[4]28,900 | .... | [1]5,000 | .... | .... | .... | .... |
|  | Grandpuits | 92,000 | 46,900 | [3]16,000 | [1]28,800 | [2]12,900 | .... | .... | [1]23,500<br>[4]26,100 | [2]2,900 | .... | .... | .... | .... | .... |
|  | Esso SAF–Fos sur Mer | 100,000 | 30,000 | .... | [1]22,000 | [1]16,000 | .... | .... | [1]16,000<br>[2]7,000<br>[4]48,000<br>[7]16,000 | .... | .... | .... | .... | .... | .... |
|  | Port Jerome | 136,000 | 56,000 | .... | [1]24,000 | [1]16,000 | .... | .... | [1]16,000<br>[2]7,000<br>[4]36,000<br>[6]4,000<br>[7]20,000 | .... | .... | 7,000 | .... | .... | .... |
|  | Mobil Oil Francaise–Notre Dame de Gravenchon | 57,000 | 36,500 | .... | .... | [2]13,300 | .... | .... | [1]13,000<br>[4]13,000 | .... | [6]7,000 | 5,500 | 1,500 | .... | .... |
|  | Shell Francaise–Berre l'Etang | 128,000 | 50,000 | [3]23,000 | [1]38,000 | [2]19,000 | .... | [2]35,000 | [2]33,000 | .... | .... | .... | 5,500 | .... | .... |
|  | Petit Couronne | 158,000 | 90,000 | [3]12,000 | [1]20,000 | [2]28,000 | .... | [2]33,000 | [2]48,000 | .... | .... | 7,500 | 9,000 | .... | .... |
|  | Ste. Francaise des Petroles BP–Dunkirk | .... | 17,500 | .... | .... | .... | .... | .... | .... | .... | .... | 6,000 | .... | .... | .... |
|  | Lavera | 177,630 | 70,310 | [3]21,120 | [1]23,220 | [1]5,160 | [1]13,440 | [4]29,240 | [5]14,000 | .... | [1]4,300 | .... | 2,200 | [1]30.0 | .... |
|  | **Total** | **1,815,630** | **729,910** | **172,990** | **349,480** | **246,760** | **13,440** | **267,040** | **614,540** | **10,150** | **23,960** | **33,400** | **62,580** | **30.0** | .... |
|  | Solvent extraction: [1]9,800 b/cd. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **GABON** | Ste. Gabonaise de Raffinage–Port Gentil | **24,000** | .... | **[2]7,200** | .... | **[3]1,400** | .... | .... | **[4]5,000** | .... | .... | .... | .... | .... | .... |
| **GERMANY** | Addinol Mineralol GmbH Lutzkendorf–Krumpa, Kreis Merseburg[1] | 16,500 | 8,500 | .... | .... | .... | .... | .... | ... | .... | .... | 5,400 | .... | .... | .... |
|  | BP Oiltech Gmbh–Hamburg | .... | 185,000 | .... | .... | .... | .... | .... | .... | .... | .... | 4,200 | .... | [5]327.0 | .... |
|  | DEA Mineraloel AG–Heide | 80,000 | 30,000 | [3]14,000 | [1]9,000 | [4]20,000 | .... | [3]11,000<br>[4]18,000 | [1]25,000 | *450 | [1]5,000 | .... | 5,000 | .... | .... |
|  | UK-Wesseling | 100,000 | 50,000 | [3]26,000 | .... | [4]19,000 | [1]40,000 | [4]14,000 | [1]24,000 | *2,000 | [1]7,000 | .... | .... | .... | ... |
|  | DMP Mineralol Petrochemie GmbH–Burghausen | 72,000 | .... | [5]27,500<br>[6]5,462 | .... | .... | .... | .... | [5]18,700 | .... | [2]2,340 | .... | .... | .... | 685 |

|  |  |  | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
|  | Deutsche Shell AG–Godorf | 170,000 | 73,000 | [2]18,000<br>[3]7,000 | .... | [2]17,000<br>[6]21,000 | [1]19,000 | [2]32,000 | [2]52,000<br>[3]34,000<br>[4]12,000 | .... | [1]14,000<br>[2]3,000<br>[6]6,000 | .... | 12,000 | .... | .... |
|  | Harburg-Grasbrook | 86,000 | 45,000 | [3]14,000 | [1]15,000 | [6]16,000 | .... | [2]14,000<br>[5]6,000 | [2]31,000<br>[3]2,000 | .... | .... | 6,100 | 7,000 | .... | .... |
|  | Erdoel Raffinerie Neustadt GmbH–Neustadt-Donau | 144,000 | 65,400 | [3]13,000 | [1]26,000 | [1]17,700 | .... | [4]27,200 | [1]22,500 | .... | .... | .... | 5,400 | .... | .... |
|  | Esso AG–Ingolstadt | 95,000 | 31,400 | .... | [1]24,500 | [2]15,600 | .... | [4]47,400 | [2]20,400 | .... | .... | .... | 7,400 | .... | .... |
|  | Karlsruhe | 150,000 | 53,900 | [2]28,000<br>[3]23,000<br>[5]19,900 | .... | [2]28,000 | .... | [4]73,000 | [2]43,000 | .... | .... | .... | 10,000 | .... | 1,200 |
|  | Holborn Europa Raffinerie GmbH–Harburg | 78,000 | 15,000 | .... | [1]18,750 | [2]14,700 | .... | .... | [1]31,700<br>[3]3,500<br>[4]38,400 | .... | .... | .... | .... | .... | .... |
|  | Hydrierwerk Zeitz GmbH–Zeitz | 73,700 | 26,900 | .... | .... | .... | [1]3,600<br>[3]8,400 | [4]12,400 | .... | .... | .... | 2,200 | 3,600 | [1]7.9<br>[3]13.9 | .... |
|  | Leune-Werke AG–Leuna | 100,000 | 70,000 | [3]26,000 | .... | [2]15,000 | [1]48,000 | [4]12,000 | [1]12,000 | ....<br>[2]5,000<br>[3]2,000 | .... | .... | .... | [3]115 | .... |
|  | Mobil Oil AG–Woerth | 93,000 | 23,000 | .... | [1]19,000 | [2]15,900 | .... | .... | [1]28,000<br>[5]26,000 | .... | [6]5,500 | .... | 5,000 | .... | .... |
|  | Oberrheinische Mineraloiwerke GmbH–Karlsruhe | 174,000 | 102,000 | [3]31,000 | [1]66,000 | [2]11,400<br>[6]21,300 | .... | [3]66,000<br>[4]30,000 | [1]37,400 | [2]10,200 | .... | .... | 11,800 | .... | .... |
|  | PCK Schwedt AG–Schwedt | 230,000 | 94,300 | [3]26,800<br>[6]12,100 | [1]37,000 | [2]23,000<br>[6]18,000 | .... | [3]36,500<br>[4]28,000 | [1]45,000<br>[4]30,000<br>[7]660 | [2]5,500 | [1]8,000<br>[2]4,000 | .... | 2,400 | [1]8.1 | .... |
|  | Raffineriegesellschaft–Vohburg/Ingolstadt | 120,000 | 40,000 | [2]9,900<br>[3]26,000 | [1]19,000 | [2]18,000<br>[6]18,800 | .... | [4]29,400 | [2]78,850 | .... | [6]12,000 | .... | 4,200 | .... | .... |
|  | Ruhr Oel GmbH–Gelsenkirchen | 215,400 | 48,200 | [3]16,000<br>[5]28,000 | [1]6,000 | [1]11,900<br>[5]27,000 | [1]30,000 | [4]63,000 | [1]53,000 | .... | [1]10,620<br>[2]2,150<br>[3]2,420 | .... | 6,000 | [5]25.0 | 1,200 |
|  | Wintershall AG–Lingen | 65,000 | 31,700 | [5]15,300 | .... | [2]12,200<br>[4]15,000 | [1]19,200 | [4]21,300 | [1]15,000<br>[2]2,500 | .... | [1]500<br>[2]900<br>[3]2,200 | .... | 3,400 | [1]40.0 | 420 |
|  | Salzbergen | 2,800 | 4,800 | .... | .... | .... | .... | .... | [6]2,500 | .... | .... | 2,900 | .... | [1]0.5 | .... |
|  | **Total** | **2,065,400** | **998,100** | **386,962** | **240,250** | **376,500** | **168,200** | **541,200** | **696,110** | **18,150** | **85,630** | **20,800** | **83,200** | **537.4** | **3,505** |

Solvent extraction: [1]5,000 b/cd.
Note: Some of the smaller east german refineries are not accounted for.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GHANA** | Ghanaian Italian Petroleum CL–Tema | **26,600** | .... | .... | .... | [2]6,175 | .... | .... | [1]6,175 | .... | .... | .... | .... | .... | .... |
| **GREECE** | Hellenic Aspropyrgos Refinery SA–Aspropyrgos | 120,800 | 57,500 | [3]21,400 | [1]32,600 | [2]9,800<br>[6]20,600 | [4]27,900 | [4]15,800 | [1]24,900 | *7,450 | [6]7,000 | .... | .... | [5]9.6 | .... |
|  | Motor Oil (Hellas) Corinth Refineries SA–Aghii Theodori | 100,000 | 57,000 | [3]19,000 | [1]27,300 | [2]8,500 | .... | [4]27,000 | [2]15,700 | [2]2,156<br>*1,200 | [5]4,200 | .... | .... | .... | .... |
|  | Petrola Hellas SA–Elefsis | 108,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Thessaloniki Refining Co. AE–Thessaloniki | 66,500 | 8,100 | .... | .... | [2]8,100 | .... | .... | [2]16,500<br>[4]18,800 | .... | .... | .... | 2,800 | .... | .... |
|  | **Total** | **395,300** | **122,600** | **40,400** | **59,900** | **47,000** | **27,900** | **42,800** | **75,900** | **10,806** | **11,200** | **....** | **2,800** | **9.6** | **....** |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. °Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **GUATEMALA** | Texas Petroleum Co.–Escuintla | 16,000 | .... | .... | .... | [2]3,000 | .... | .... | [1]3,000<br>[4]2,000 | .... | .... | .... | .... | .... | .... |
| | **Total** | **16,000** | .... | .... | .... | **3,000** | .... | .... | **5,000** | .... | .... | .... | .... | .... | .... |
| **HONDURAS** | Refineria Texas de Honduras SA–Puerto Cortes | 14,000 | .... | .... | .... | [1]1,800 | .... | .... | [1]3,000<br>[4]2,000 | .... | .... | .... | .... | .... | .... |
| | **Total** | **14,000** | .... | .... | .... | **1,800** | .... | .... | **5,000** | .... | .... | .... | .... | .... | .... |
| **HUNGARY** | Dunai KV–Százhalombatta | 150,000 | 84,000 | [3]13,300 | [1]20,000 | [2]23,000 | .... | .... | [1]23,000<br>[4]35,000<br>[6]2,200 | [2]3,300 | [1]7,100<br>[6]2,700 | 4,000 | 6,300 | .... | .... |
| | Tiszai KV–Leninváros | 60,000 | 30,000 | .... | .... | .... | .... | .... | [5]18,400 | .... | .... | .... | .... | .... | .... |
| | Zalai KV–Zalaegerszeg | 10,000 | 6,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4,500 | .... | .... |
| | **Total** | **220,000** | **120,000** | **13,300** | **20,000** | **23,000** | .... | .... | **76,600** | **3,300** | **9,800** | **4,000** | **10,800** | .... | .... |
| **INDIA** | Bharat Petroleum CL–Mahul, Bombay | 156,600 | 42,500 | .... | [1]33,800 | [1]5,400 | .... | .... | .... | .... | [1]1,800<br>[2]375 | .... | 10,000 | .... | .... |
| | Bongaigaon Refinery & Petrochemicals Ltd.–Bongaigaon, Assam | 27,610 | .... | [5]9,675 | .... | [2]1,833 | .... | .... | [1]1,833 | .... | [1]694<br>[6]3,828 | .... | .... | .... | 203 |
| | Cochin Refineries Ltd.–Ambalamugal | 90,000 | 34,200 | [3]19,600 | [1]20,000 | [1]5,000 | .... | .... | [2]9,400<br>[7]18,000 | .... | .... | .... | 6,900 | .... | .... |
| | Hindustan Petroleum CL–Mahul, Bombay[1] | 111,650 | 52,500 | .... | [1]12,000 | .... | .... | .... | [6]6,600 | .... | .... | 4,800 | 9,400 | [5]86.3 | .... |
| | Visakhapatnam | 90,000 | 43,200 | .... | [1]19,200 | .... | .... | .... | .... | .... | .... | .... | 2,440 | .... | .... |
| | Indian Oil CL–Barauni, Bihar[2] | 70,200 | 26,000 | [5]22,100 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 582 |
| | Digboi, Assam | 11,700 | .... | [5]1,000 | .... | .... | .... | .... | .... | .... | .... | 1,800 | 400 | .... | .... |
| | Guwahati, Assam | 18,100 | .... | [5]6,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 145 |
| | Koyali, Gujarat | 205,700 | 59,000 | [3]19,500 | [1]20,100 | [2]8,300 | .... | .... | [1]8,300 | .... | [1]1,850 | .... | 4,700 | .... | .... |
| | Haldia, West Bengal[3] | 61,100 | 23,500 | [3]9,600 | .... | [1]5,300 | .... | .... | [1]5,300<br>[4]13,400<br>[6]4,800 | .... | .... | 3,250 | .... | .... | .... |
| | Mathura, Uttar Pradesh | 165,000 | 47,300 | [3]19,500 | [1]20,100 | .... | .... | .... | .... | .... | .... | .... | 7,700 | .... | .... |
| | Madras Refineries Ltd.–Madras | 114,700 | 36,800 | [2]4,900<br>[3]3,000 | [1]11,770 | [1]2,400 | .... | .... | [1]2,400<br>[4]25,100<br>[6]4,000 | .... | .... | 4,000 | 3,800 | [1]9.5 | .... |
| | **Total** | **1,122,360** | **365,000** | **114,875** | **136,970** | **28,233** | .... | .... | **99,133** | .... | **8,547** | **13,850** | **45,340** | **95.8** | **930** |
| **INDONESIA** | Pertamina–Balikpapan, Kalimantan | 231,500 | 84,800 | .... | .... | [6]18,000 | [1]49,700 | .... | [1]18,000 | .... | .... | .... | .... | [1]60.0 | .... |
| | Cilacap, Central Java | 300,400 | 30,700 | [3]49,900 | .... | [1]12,000<br>[6]18,000 | .... | [4]18,000 | [1]18,100 | .... | .... | 5,000 | 7,500 | .... | .... |
| | Dumai, Central Sumatra | 114,400 | 83,500 | [4]31,800 | .... | [1]5,600<br>[6]7,900 | [1]50,400 | .... | [1]6,300<br>[3]9,100 | .... | .... | .... | .... | [1]78.8 | .... |
| | Musi, South Sumatra | 114,300 | 30,000 | .... | [1]12,600 | .... | .... | .... | .... | [1]300<br>°300 | .... | .... | .... | .... | .... |
| | Pangakalan Brandan, North Sumatra | 5,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Sungai Pakning, Central Sumatra | 48,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **813,600** | **229,000** | **81,700** | **12,600** | **61,500** | **100,100** | **18,000** | **51,500** | **600** | .... | **5,000** | **7,500** | **138.8** | .... |

Solvent extraction: [1]10,000 b/cd, [2]4,000 b/cd, [3]16,000 b/cd.

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **IRAN** | National Iranian Oil Co.– |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Abadan | 190,000 | 69,640 | [3]11,700 | .... | [6]41,555 | .... | [4]17,430 | [1]71,175 | .... | .... | 4,920 | 17,550 | [1]116.0 | .... |
|  | Esfahan | 200,000 | 96,800 | [3]38,000 | .... | [6]29,600 | [1]30,000 | .... | [1]29,000 | .... | .... | .... | 5,450 | 70.0 | .... |
|  | Shiraz | 40,000 | 18,400 | [3]8,800 | .... | [5]6,245 | [1]9,380 | [4]3,120 | [1]5,225 | .... | .... | .... | .... | .... | .... |
|  | Tabriz | 80,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Tehran | 210,000 | 100,000 | [3]34,000 | .... | [6]28,000 | [1]26,000<br>[2]27,800 | .... | .... | .... | .... | 6,000 | 7,000 | .... | .... |
|  | **Total** | **720,000** | **284,840** | **92,500** | .... | **105,400** | **93,180** | **20,550** | **105,400** | .... | .... | **10,920** | **30,000** | **186.0** | .... |
| **IRAQ** | Oil Refineries Administration–Baiji | 150,000 | 65,000 | .... | .... | 22,000<br>16,500 | 38,000 | 31,000<br>28,000<br>41,000 | .... | .... | .... | .... | .... | 64.0 | .... |
|  | Basra | 70,000 | 17,650 | .... | .... | .... | .... | .... | .... | .... | .... | 2,008 | .... | .... | .... |
|  | Daura | 71,000 | .... | .... | .... | 5,000 | .... | .... | 13,000 | .... | .... | 8,160 | 1,815 | .... | .... |
|  | K3-Haditha | 7,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Khanaqin | 12,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Mufthia | 4,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Qaiyarah, Mosul | 2,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4,900 | .... | .... |
|  | Iraqi Company for Oil Operations–Kirkuk | 2,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | **Total** | **318,500** | **82,650** | .... | .... | **43,500** | **38,000** | **100,000** | **13,000** | .... | .... | **10,168** | **6,715** | **64.0** | .... |
|  | Note: Present status uncertain due to Middle East crisis. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **IRELAND** | Irish National Refining plc–Whitegate | **56,000** | .... | .... | .... | [4]11,000 | .... | [4]5,500 | [2]11,000 | .... | .... | .... | .... | .... | .... |
| **ISRAEL** | Oil Refineries Ltd.–Ashdod | 70,000 | 35,000 | [3]25,000 | .... | [2]10,000 | .... | [4]25,000 | [1]15,000 | .... | .... | .... | .... | .... | .... |
|  | Haifa | 110,000 | 55,000 | [3]35,000 | [1]22,000 | [2]15,000 | .... | [4]18,000 | [1]15,000 | .... | .... | .... | 3,000 | .... | .... |
|  | **Total** | **180,000** | **90,000** | **60,000** | **22,000** | **25,000** | .... | **43,000** | **30,000** | .... | .... | .... | **3,000** | .... | .... |
| **ITALY** | Agip Plas SpA–Livorno | 84,000 | 36,000 | .... | .... | [2]9,500<br>[6]12,000 | .... | [4]31,700 | [2]22,000 | .... | .... | 9,300 | 3,500 | .... | .... |
|  | Agip Raffinazione SpA–Porto Marghera | 70,000 | 38,000 | [2]13,500<br>[3]27,000 | .... | [2]15,000 | .... | [4]27,000 | [2]15,000 | .... | [5]6,000 | .... | 3,500 | .... | .... |
|  | Rho, Milan | 80,000 | 32,800 | .... | [1]14,300 | [2]17,000 | .... | [4]15,400 | [2]20,700 | [2]1,600 | .... | 1,750 | 4,300 | .... | .... |
|  | Sannazzaro, Pavia | 200,000 | 84,500 | [3]32,000 | [1]30,000 | [2]12,000<br>[6]16,700 | .... | [4]41,000 | [1]12,000<br>[2]27,000 | [2]3,200 | [6]11,000 | .... | .... | .... | .... |
|  | Taranto | 84,000 | 13,500 | [2]27,000<br>[3]37,250 | .... | [2]17,000 | .... | [4]34,200 | [2]24,000 | .... | [6]3,900 | .... | .... | [2]10.0 | .... |
|  | Anonima Petroli Italiana–Falconara, Marittima | 63,000 | 19,400 | [2]4,500<br>[3]31,000 | .... | [2]11,000 | .... | .... | [1]20,300<br>[4]26,900 | .... | [6]4,750 | .... | .... | [5]3.8 | .... |
|  | Arcola Petrolifera SpA–La Spezia | 17,358 | 8,168 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Esso Italiana SpA–Augusta, Siracusa | 180,000 | 94,000 | .... | [1]45,300 | [2]22,300 | .... | .... | [1]22,300<br>[6]23,000 | [2]9,100 | [4]5,300 | 16,900 | 11,500 | .... | .... |
|  | Industrie Chimiche Italiane de Petrolio SpA-Frassino, Mantova | 55,000 | 19,600 | [2]8,000<br>[3]19,000 | .... | [2]7,000 | .... | .... | [2]14,000<br>[4]15,000 | .... | [6]2,500 | .... | .... | .... | .... |
|  | Iplom SpA–Busalla | 46,500 | 12,600 | [3]13,100 | .... | .... | .... | .... | .... | .... | .... | 6,500 | 12,500 | .... | .... |
|  | Isab–Priolo Gargallo | 220,000 | 110,000 | [2]15,000<br>[3]39,000 | .... | [4]34,500 | [1]59,000 | [4]86,000 | [2]59,000 | .... | [6]15,000 | .... | .... | [1]18.0 | .... |

| WORLDWIDE REFINING | | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| | Kuwait Raffinazione E Chimica–Naples | 100,000 | 35,000 | [3]8,700 | [2]20,000 | [2]26,000 | .... | .... | [1]26,000<br>[4]10,000<br>[5]5,000 | [2]3,800 | [1]9,000<br>[3]1,800 | .... | 4,000 | .... | .... |
| | Raffineria di Roma SpA–Rome | 81,500 | 11,300 | [3]28,400 | .... | [2]14,200 | .... | [2]17,000 | [2]19,900 | .... | [4]5,200 | .... | 9,620 | .... | .... |
| | Raffineria Mediterranea Spa–Milazzo | 160,000 | 78,000 | .... | [1]40,000 | [2]12,000 | .... | [4]14,000 | [2]15,000 | [1]5,000 | .... | .... | .... | .... | .... |
| | Raffineria Siciliana SrL–Gela | 105,000 | 52,500 | [4]29,000 | [1]35,000 | [2]13,850 | .... | [2]15,000<br>[4]17,000 | [1]16,500 | [2]10,000 | [1]6,700<br>[2]700<br>[4]8,050 | .... | .... | [3]17.0<br>[5]8.0 | 1,350 |
| | Saras SpA–Sarroch | 285,000 | 107,500 | .... | [1]72,000 | [5]27,000 | .... | .... | [1]27,000<br>[4]73,500 | [2]6,800 | .... | .... | .... | .... | .... |
| | Sarpom–S. Martino Di Trecate | 219,000 | 26,100 | .... | [1]17,700 | [2]18,500<br>[4]8,100 | .... | .... | [2]65,800<br>[4]43,000 | *1,400 | .... | .... | 14,000 | .... | .... |
| | ENI–Priolo | 240,000 | 50,000 | [3]25,000 | [1]32,000 | [2]9,000 | .... | [4]18,000 | [1]9,000 | .... | [1]12,000<br>[2]1,300 | .... | .... | .... | .... |
| | Tamoil Italia SpA–Cremona | 95,000 | .... | [3]33,000 | .... | [2]12,400 | .... | [4]11,000 | [1]16,400<br>[3]1,900 | .... | [6]3,600 | .... | .... | .... | .... |
| | **Total** | **2,385,358** | **828,968** | **390,450** | **386,300** | **315,050** | **59,000** | **327,300** | **630,200** | **40,900** | **96,800** | **34,450** | **62,920** | **56.8** | **1350** |
| **IVORY COAST** | Ste. Ivoirienne de Raffinage–Abidjan | 59,000 | 30,000 | .... | .... | [2]13,600 | [1]14,200 | [1]12,800 | [4]17,200 | .... | .... | .... | .... | .... | .... |
| | Ste. Multinationale de Bitumes—Abidjan | 10,000 | 7,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 5,000 | .... | .... |
| | **Total** | **69,000** | **37,500** | **....** | **....** | **13,600** | **14,200** | **12,800** | **17,200** | **....** | **....** | **....** | **5,000** | **....** | **....** |
| **JAMAICA** | Petrojam Ltd.–Kingston | 34,200 | 1,900 | .... | .... | [1]3,240 | .... | .... | [1-2]5,850<br>[4]13,500 | .... | .... | .... | .... | .... | .... |
| | **Total** | **34,200** | **1,900** | **....** | **....** | **3,240** | **....** | **....** | **19,350** | **....** | **....** | **....** | **....** | **....** | **....** |
| **JAPAN** | Cosmo Oil CL–Chiba | 209,000 | 57,000 | .... | [1]30,400 | [2]34,675 | .... | [1]57,000<br>[2]33,250 | [1]36,100<br>[2]7,600<br>[4]72,200 | .... | .... | .... | .... | [1]21.0<br>[2]62.0 | .... |
| | Sakaide | 133,000 | 39,425 | .... | [1]16,150 | [2]9,500 | .... | [1]26,600<br>[2]16,340 | [1]13,300<br>[4]53,200 | .... | .... | .... | .... | [5]31.8 | .... |
| | Sakai | 104,500 | 32,300 | .... | [1]18,525 | [2]6,650 | .... | [2]19,000 | [1]8,075<br>[4]27,550 | .... | .... | .... | .... | [5]10.6 | .... |
| | Yokkaichi City | 166,250 | 70,300 | .... | [1]23,750 | [2]5,700<br>[4]10,450 | .... | [2]33,250 | [1]17,100<br>[4]61,700<br>[6]6,175 | .... | .... | 6,175 | .... | [5]12.0 | .... |
| | Fuji Oil CL–Sodegaura,Chiba | 126,600 | 79,600 | [6]19,000 | [1]14,000 | [2]16,300 | .... | [2]52,400 | [1]27,000<br>[4]47,900<br>[7]6,800 | .... | .... | .... | .... | [2]27.9 | .... |
| | General Sekiyu Seisei KK–Sakai | 131,400 | 63,000 | .... | [1]32,500 | [2]26,100 | .... | [3]36,000 | [2]36,000<br>[4]54,300 | .... | [1]17,300 | .... | .... | [2]21.6 | .... |
| | Idemitsu Kosan CL–Chita, Aichi | 123,500 | .... | .... | [1]27,000 | [5]16,200 | .... | [1]49,500 | [1]23,400<br>[4]43,200 | [1]5,400 | .... | .... | .... | [2]63.4<br>[5]13.2 | .... |
| | Himeji, Hyogo | 104,500 | .... | .... | .... | [2]12,600 | .... | [1]36,000 | [1]25,200<br>[4]31,500 | .... | .... | .... | .... | [2]33.6 | .... |
| | Ichihara, Chiba | 199,500 | 57,000 | .... | [1]37,800 | [2]15,300 | [3]9,450 | [1]36,000<br>[3]35,100 | [1]38,700<br>[4]47,700 | .... | .... | 5,170 | 7,900 | [2]64.9<br>[5]3.5 | .... |
| | Tokuyama, Yamaguchi | 95,000 | 47,500 | .... | [1]20,700 | .... | .... | [3]40,500 | [1]13,500<br>[4]31,500 | .... | .... | .... | 1,530 | [2]18.0 | .... |
| | Tomakomai, Hokkaido | 85,500 | 22,800 | .... | .... | [2]16,200 | [1]13,500 | .... | [1]24,300<br>[4]22,860 | .... | .... | .... | .... | [5]2.4 | .... |

| | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| Kainan Petroleum Refining CL–Kaiwan City, Wakayama | 64,000 | 37,500 | .... | .... | .... | .... | .... | [4]20,000<br>[5]1,500<br>[6]9,000 | .... | .... | 11,600 | 17,500 | [2]4.0 | .... |
| Kashima Oil CL–Kashima, Ibaragi | 150,000 | 42,000 | .... | [1]17,500 | [2]7,500<br>[5]14,000 | .... | [1]20,000<br>[2]25,000<br>[4]55,000 | [1]22,500 | .... | .... | .... | .... | [1]22.5 | .... |
| Koa Oil CL–Marifu | 110,000 | 49,000 | [5]17,500 | [1]20,000 | [2]11,000 | .... | [2]10,000 | [1]11,000<br>[4]29,000 | .... | .... | .... | 1,700 | [2]8.0 | 500 |
| Osaka | 80,000 | 55,000 | .... | [1]23,500 | [2]11,000 | .... | [2]15,000 | [1]13,000<br>[4]14,000 | .... | .... | .... | .... | .... | .... |
| Kyenus Sekiyu Seisei KK–Kawasaki | 66,500 | .... | .... | .... | .... | .... | .... | [4]21,600 | .... | .... | .... | .... | .... | .... |
| Kyokuto Petroleum Ltd.–Chiba | 125,000 | 83,000 | .... | .... | [2]20,000 | [1]28,000 | .... | [1]22,000<br>[4]23,000 | .... | .... | .... | 3,800 | [2]25.0<br>[5]8.5 | .... |
| Kyushu Oil CL–Oita | 130,000 | 66,000 | .... | [1]16,500 | [2]8,000 | .... | [2]33,000<br>[4]27,000 | [1]9,000 | .... | .... | .... | .... | [5]14.9 | .... |
| Mitsubishi Oil CL–Kawasaki | 55,000 | .... | .... | .... | [2]10,000 | .... | [4]17,000 | [1]10,000 | .... | .... | .... | 1,800 | .... | .... |
| Mizushima | 220,000 | 97,000 | .... | [1]34,000 | [2]25,000<br>[6]18,500 | [1]11,000 | [1]45,000 | [1]43,500<br>[3]14,000<br>[6]4,100 | *880 | [1]12,700 | 2,800 | 5,700 | [2]60.0 | .... |
| Nansei Sekiyu KK–Nishihara, Okinawa | 54,000 | .... | .... | .... | [2]8,600 | .... | .... | [2]21,100<br>[4]13,500 | .... | .... | .... | .... | .... | .... |
| Nihonkai Oil CL–Toyama | 43,700 | 9,500 | .... | .... | [2]4,950 | .... | .... | [2]9,500<br>[4]7,125 | .... | .... | .... | .... | .... | .... |
| Nippon Mining CL–Chita... | 85,000 | 40,000 | .... | [1]13,000 | [2]22,000 | .... | [2]37,000 | [2]43,000<br>[4]46,000 | .... | [1]4,600<br>[2]2,000<br>[3]1,300 | .... | .... | [1]25.0 | .... |
| Funakawa | 6,000 | 2,740 | .... | .... | .... | .... | .... | .... | .... | .... | 1,070 | .... | .... | .... |
| Mizushima[1] | 190,200 | 107,000 | .... | [1]38,000 | [2]20,000 | .... | [1]31,000<br>[2]60,000 | [1]28,300<br>[4]69,100<br>[6]6,000 | [1]5,000 | .... | 4,900 | .... | [1]29.0<br>[2]30.0 | .... |
| Nippon Oil CL–Niigata | 26,000 | 2,000 | .... | [2]4,000 | .... | .... | .... | [4]21,300 | .... | .... | .... | 425 | .... | .... |
| Nippon Petroleum Refining CL–Muroran | 150,000 | 61,000 | .... | [1]21,000 | [2]21,000 | [1]40,000 | [1]12,500 | [1]32,000<br>[4]48,000 | .... | .... | .... | 4,160 | [5]62.0 | .... |
| Nakagusuku, Okinawa | .... | .... | .... | .... | [2]2,500 | .... | .... | [1]2,500 | .... | .... | .... | .... | .... | .... |
| Negishi | 305,000 | 130,000 | [3]20,000 | [1]39,000 | [2]20,000<br>[6]30,000 | .... | [2]81,000 | [1]66,000<br>[4]72,500<br>[7]3,000 | [1]6,000 | .... | 4,310 | 6,660 | [5]22.0 | .... |
| Yokohama | .... | .... | .... | .... | [2]1,300 | .... | .... | [1]3,300<br>[4]7,300 | .... | .... | 1,250 | .... | .... | .... |
| Okinawa Sekiyu Seisei–Yonashiro, Okinawa | 57,000 | .... | .... | .... | .... | .... | [1]34,200<br>[2]13,500 | [4]18,000 | .... | .... | .... | .... | [2]42.7 | .... |
| Seibu Oil CL–Yamaguchi | 110,100 | 42,200 | .... | [1]19,900 | [2]20,000 | .... | [1]40,100<br>[2]27,700 | [2]48,300<br>[4]29,400 | .... | [6]5,200 | .... | .... | [1]42.4 | .... |
| Showa Shell Sekiyu KK–Kawasaki | 96,400 | 27,500 | .... | .... | [2]13,800 | .... | [2]7,600<br>[5]14,200 | [2]24,900<br>[4]18,700 | .... | [6]5,500 | .... | .... | .... | .... |
| Niigata | 27,500 | .... | .... | .... | [2]4,300 | .... | [4]2,000 | [4]11,600 | .... | .... | .... | .... | .... | .... |
| Showa Yokkaichi Sekiyu CL–Yokkaichi | 165,200 | 96,300 | .... | [1]22,600 | [2]40,600 | .... | [2]36,900<br>[5]35,600 | [2]61,500<br>[4]39,200 | .... | [1]15,200<br>[5]5,000 | 5,500 | 6,300 | [1]28.3 | .... |
| Taiyo Oil CL–Ehime | 61,750 | 19,000 | .... | .... | [1]5,700 | [2]11,400 | [2]11,400 | [2]7,790 | .... | .... | .... | .... | .... | .... |
| Tonen Corp.–Kawasaki | 190,000 | 116,850 | .... | [1]74,100 | [2]18,600<br>[4]22,320 | .... | [3]54,000 | [2]52,200<br>[4]63,900 | [1]6,510 | .... | .... | .... | [2]19.5 | .... |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
| | Wakayama | 157,700 | 65,500 | .... | [1]34,200 | [2]34,875 | .... | [2]22,500 | [2]33,750<br>[4]51,300 | [1]2,046 | .... | 6,100 | .... | [1]24.8 | .... |
| | Toa Oil CL–Kawasaki | 59,700 | 48,600 | [6]20,400 | [1]27,100 | [2]7,100 | .... | [3]51,700 | [1]18,200<br>[2]9,000<br>[4]22,000 | .... | .... | .... | .... | [1]32.8 | .... |
| | Toho Oil CL–Owase | 35,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Tohoku Oil CL–Sendai | 83,900 | 54,700 | .... | .... | [2]12,000 | .... | [3]31,100 | [1]12,000<br>[4]18,500 | .... | .... | .... | 6,200 | .... | .... |
| | **Total** | **4,383,400** | **1,721,365** | **76,900** | **629,975** | **607,970** | **113,350** | **1,321,940** | **2,097,325** | **25,836** | **68,800** | **48,875** | **63,675** | **887.3** | **500** |

Solvent extraction: [1]9,000 b/cd.

| WORLDWIDE REFINING | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **JORDAN** | Jordan Petroleum Refinery–Zerka | 100,000 | 16,500 | ... | [1]4,250 | [2]8,640 | [1]4,800 | .... | [1]14,850 | .... | .... | .... | 4,000 | [2]7.9 | .... |
| | **Total** | **100,000** | **16,500** | .... | **4,250** | **8,640** | **4,800** | .... | **14,850** | .... | .... | .... | **4,000** | **7.9** | .... |
| **KENYA** | Kenya Petroleum Refineries Ltd.–Mombasa | 90,000 | 1,700 | .... | .... | [1]3,800<br>[2]5,200 | .... | .... | [4]33,000 | .... | .... | .... | 900 | .... | .... |
| | **Total** | **90,000** | **1,700** | .... | .... | **9,000** | .... | .... | **33,000** | .... | .... | .... | **900** | .... | .... |
| **KOREA, N.** | Government-owned, Unggi | **42,000** | | | | | | | | | | | | | |
| **KOREA, S.** | Honam Oil Refinery CL–Yocheon | 342,000 | 9,000 | [3]29,700 | .... | [2]15,300 | .... | .... | [2]22,500 | .... | .... | .... | 3,600 | .... | .... |
| | Kukdong Oil CL–Busan[1] | 10,000 | 7,000 | .... | .... | .... | .... | .... | [2]2,000<br>[6]1,200 | .... | .... | 2,000 | 4,000 | [2]0.4 | .... |
| | Daesan | 60,000 | 41,000 | [5]19,000 | .... | [2]3,000 | [1]22,000 | .... | [2]7,000<br>[4]12,000 | .... | .... | 1,000 | 3,727 | [2]54.0 | 1,200 |
| | Kyung In Energy CL–Inchon | 60,000 | .. .. | .... | .... | [2]3,600 | .... | .... | [1]3,600<br>[4]4,000 | .... | .... | .... | .... | .... | .... |
| | Ssangyong Oil Refining CL–Onsan[2] | 90,000 | 22,000 | .... | .... | [1]4,000 | [3]7,000 | [4]21,000 | [1]4,000<br>[2]1,100<br>[6]2,400 | .... | .... | 4,200 | 5,000 | [2]14.0 | .... |
| | Yukong Ltd.–Ulsan | 305,000 | 4,400 | .... | .... | [2]17,650<br>[6]18,900 | .... | .... | [1]38,900<br>[4]10,500<br>[7]2,600 | .... | [1]11,930<br>[2]4,900<br>[3]800 | .... | 2,600 | .... | .... |
| | **Total** | **867,000** | **83,400** | **48,700** | .... | **62,450** | **29,000** | **21,000** | **111,800** | .... | **17,830** | **7,200** | **18,927** | **68.4** | **1,200** |

Solvent extraction: [1]2,100 b/d. [2]8,000 b/d.

| WORLDWIDE REFINING | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KUWAIT** | Getty Oil Co. (subsidiary of Texaco Inc.)–Mina Al-Zour | 72,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Kuwait National Petroleum Co. –Mina Abdulla | 190,000 | 117,000 | [5]54,000 | .... | .... | [1]34,000 | [1]88,000 | [2]7,000<br>[4]66,000 | .... | .... | .... | .... | [1]161.0 | 1,900 |
| | Mina Al-Ahmadi | 370,000 | 90,000 | .... | [1]28,000 | [2]33,000 | [1]34,000 | [1]117,000 | [1]34,000<br>[4]66,000 | .... | .... | .... | 5,000 | [1]156.0 | .... |
| | Shuaiba | 187,000 | 131,000 | .... | [2]14,000 | .... | [1]60,000<br>[2]42,000 | .... | [1]25,000<br>[4]65,000 | .... | .... | .... | .... | [1]210.0 | .... |
| | **Total** | **819,000** | **338,000** | **54,000** | **42,000** | **33,000** | **170,000** | **205,000** | **283,000** | .... | .... | .... | **5,000** | **527.0** | **1,900** |

| WORLDWIDE REFINING | Company and refinery location | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
| **LEBANON** | Tripoli Oil Installations–Tripoli | 20,000 | 12,730 | .... | [1]7,250 | [2]4,392 | .... | [2]7,392 | .... | .... | .... | .... | 409 | .... | .... |
| | Zahrani Oil Installations–Sidon | 17,500 | .... | .... | .... | [1]3,050 | .... | .... | [1]3,050 | .... | .... | .... | .... | .... | .... |
| | **Total** | **37,500** | **12,730** | .... | **7,250** | **7,442** | .... | **7,392** | **3,050** | .... | .... | .... | **409** | .... | .... |
| **LIBERIA** | Liberia Petroleum Refining–Monrovia | 15,000 | 1,000 | .... | .... | [1]2,000 | .... | .... | [1]2,300<br>[4]1,000 | .... | .... | .... | 200 | .... | .... |
| | **Total** | **15,000** | **1,000** | .... | .... | **2,000** | .... | .... | **3,300** | .... | .... | .... | **200** | .... | .... |
| **LIBYA** | Azzawiya Oil Refining Co.–Azzawiya | 120,000 | 3,432 | .... | .... | [2]12,982 | .... | .... | [1]16,908<br>[5]18,718 | .... | .... | 635 | 1,716 | .... | .... |
| | Ras Lanuf Oil & Gas Processing Co.–Ras Lanuf | 220,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Sirte Oil Co.–Brega | 7,600 | .... | .... | .... | [1]900 | .... | .... | [2]1,200 | .... | .... | .... | .... | .... | .... |
| | **Total** | **347,600** | **3,432** | .... | .... | **13,882** | .... | .... | **36,826** | .... | .... | **635** | **1,716** | .... | .... |
| **MADAGASCAR** | Solima–Managareza, Tamatave | **16,350** | **1,200** | **[3]7,000** | .... | **[1]2,600** | .... | **[2]3,600** | **[1]5,500** | .... | .... | .... | .... | .... | .... |
| **MALAYSIA** | Esso Malaysia Berhad–Port Dickson | 47,500 | 4,750 | .... | .... | [2]13,300 | .... | .... | [2]17,765<br>[4]13,775 | .... | .... | .... | .... | .... | |
| | Petronas Penapisan Sdn. Berhad –Kerteh, Kemaman, Terengganu | 27,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Sarawak Shell Berhad–Luton | 45,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Shell Refining Co. Berhad–Port Dickson | 90,000 | 7,000 | .... | .... | [1]4,000<br>[4]13,000 | .... | .... | [2]32,000<br>[4]5,000 | .... | .... | .... | 2,000 | .... | .... |
| | **Total** | **209,500** | **11,750** | .... | .... | **30,300** | .... | .... | **68,540** | .... | .... | .... | **2,000** | .... | .... |
| **MARTINIQUE** | Ste. Anonyme de la Raffinerie des Antilles–Fort-de-France | 12,000 | .... | .... | .... | [2]3,000 | .... | .... | [1]4,850<br>[4]3,500 | .... | .... | .... | .... | .... | .... |
| | **Total** | **12,000** | .... | .... | .... | **3,000** | .... | .... | **8,350** | .... | .... | .... | .... | .... | .... |
| **MEXICO** | Petroleos Mexicanos–Azcapotzalco | 105,000 | 48,000 | [3]20,000 | [1]24,000 | .... | .... | .... | .... | [2]3,000<br>*430 | .... | .... | .... | .... | .... |
| | Cadereyta | 235,000 | 137,000 | .... | [1]40,000 | [2]20,000 | .... | [4]50,000 | [1]36,000 | .... | .... | .... | .... | .... | .... |
| | Ciudad Madero[1] | 195,000 | 81,500 | [3]8,000<br>[4]9,000 | [1]43,000 | [2]15,000 | .... | [3]37,000 | [1]15,000 | [2]3,000<br>*420 | .... | .... | .... | [1]10.0 | 260 |
| | Minatitlan | 200,000 | 83,000 | .... | [1]24,000<br>[2]16,000 | [2]48,000 | .... | [4]38,000 | [1]51,000 | *600 | [1]3,820<br>[2]1,400 | 500 | .... | .... | .... |
| | Poza Rica | 50,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Reynosa | 9,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Salamanca | 235,000 | 101,200 | [3]4,000 | [1]40,000 | [2]24,800 | [2]18,000 | [4]28,000 | [1]33,000<br>[6]10,000 | .... | .... | 11,000 | 15,000 | [1]60.0 | .... |
| | Salina Cruz | 330,000 | 155,000 | .... | [1]40,000 | [6]20,000 | .... | [4]50,000 | [1]25,000 | .... | | | | | |
| | Tula, Hidalgo | 320,000 | 155,000 | [3]41,000 | [1]40,000 | [2]30,000 | .... | [4]50,000 | [1]36,000 | .... | .... | .... | .... | .... | .... |
| | **Total** | **1,679,000** | **760,700** | **82,000** | **267,000** | **157,800** | **18,000** | **253,000** | **206,000** | **7,450** | **8,220** | **11,500** | **15,000** | **70.0** | **260** |

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Solvent extraction: [1]38,000 b/cd.

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Production capacity, b/cd Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MOROCCO** | Samir–Mohammedia | 129,000 | 20,000 | .... | .... | $^{2}$24,000 | .... | .... | $^{1}$24,000<br>$^{5}$9,700<br>$^{6}$2,100 | .... | .... | 2,100 | 1,900 | .... | .... |
| | Ste. Cherifienne des Petroles –Sidi Kacem | 25,600 | 7,400 | .... | $^{2}$5,600 | $^{1}$2,800 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **154,600** | **27,400** | **....** | **5,600** | **26,800** | **....** | **....** | **35,800** | **....** | **....** | **2,100** | **1,900** | **....** | **....** |
| **MYANMAR** | Myanma Petrochemical Enterprise– | | | | | | | | | | | | | | |
| | Chauk | 6,000 | 2,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Thanlyin | 26,000 | 2,000 | $^{5}$5,200 | .... | .... | .... | .... | .... | .... | .... | 500 | .... | .... | 120 |
| | **Total** | **32,000** | **4,000** | **5,200** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **500** | **..** | **....** | **120** |
| | Formerly Burma | | | | | | | | | | | | | | |
| **NETHERLANDS** | Esso Nederland BV–Rotterdam | 153,200 | 65,800 | $^{6}$32,200 | .... | $^{4}$26,600 | .... | .... | $^{1}$25,200<br>$^{2}$9,900<br>$^{4}$61,200<br>$^{5}$13,500 | .... | .... | .... | .... | $^{1}$21.0 | .... |
| | Kuwait Petroleum Europoort BV–Rotterdam$^{1}$ | 75,500 | 36,600 | $^{2}$9,460<br>$^{3}$6,400 | .... | $^{4}$19,000 | .... | .... | $^{1}$36,600<br>$^{4}$27,700<br>$^{6}$5,500 | .... | $^{6}$5,950 | 4,400 | 4,000 | $^{5}$2.0 | .... |
| | Netherlands Refining Co.–Europoort & Pernis | 460,000 | 107,000 | $^{3}$67,000 | $^{1}$50,000 | $^{2}$58,000 | .... | $^{4}$78,000 | $^{1}$58,000<br>$^{4}$41,000 | $^{2}$7,250 | $^{5}$8,000 | .... | .... | .... | .... |
| | Shell Nederland Raffinaderij BV–Pernis | 348,000 | 148,000 | $^{3}$45,000 | $^{1}$78,000 | $^{2}$17,000<br>$^{6}$42,000 | $^{2}$22,000 | $^{2}$86,000 | $^{2}$138,000<br>$^{3}$8,000<br>$^{6}$300 | $^{2}$6,800 | .... | 7,100 | 5,500 | $^{1}$59.0 | .... |
| | Smid & Hollander Raffinaderij BV–Amsterdam | 10,000 | 8,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 6,000 | .... | .... |
| | Total Raffinaderij Nederland NV–Vlissingen | 150,000 | 58,000 | .... | .... | $^{3}$20,000 | $^{1}$31,000 | .... | $^{1}$15,800<br>$^{4}$26,400 | .... | .... | .... | .... | $^{1}$62.0 | .... |
| | **Total** | **1,196,700** | **423,400** | **160,060** | **128,000** | **182,600** | **53,000** | **164,000** | **467,100** | **14,050** | **13,950** | **11,500** | **15,500** | **144.0** | **....** |
| | Solvent extraction: $^{1}$3,200 b/cd. | | | | | | | | | | | | | | |
| **NETHERLANDS ANTILLES** | Refineria Isla Curazao SA–Emmastad | 320,000 | 158,000 | $^{2}$67,000 | $^{1}$42,000 | $^{2}$15,000 | .... | .... | $^{2,4}$40,000<br>$^{5,6}$40,000 | $^{2}$5,000<br>*600 | .... | 8,000 | 8,000 | .... | .... |
| | Coastal Aruba Refining Co. N.V.–San Nicolas | 150,000 | 120,000 | $^{3}$60,000 | .... | .... | $^{1}$116,000 | .... | $^{5}$45,000 | .... | .... | .... | 55,000 | $^{1}$56.0 | .... |
| | **Total** | **470,000** | **278,000** | **127,000** | **42,000** | **15,000** | **116,000** | **....** | **125,000** | **5,600** | **....** | **8,000** | **63,000** | **56.0** | **....** |
| **NEW ZEALAND** | New Zealand Refining–Whangarei$^{1}$ | 95,100 | 41,900 | .... | .... | $^{2}$26,[illegible] | [illegible] | .... | $^{1}$40,200<br>$^{4}$20,500 | .... | .... | .... | 800 | $^{1}$44.0 | .... |
| | **Total** | **95,100** | **41,900** | **....** | **....** | **26,600** | **24,500** | **....** | **60,700** | **....** | **....** | **....** | **800** | **44.0** | **....** |
| | Solvent extraction: $^{1}$10,000 b/cd. | | | | | | | | | | | | | | |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **NICARAGUA** | Esso Standard Oil SA Ltd.–Managua | 16,000 | 2,000 | .... | .... | [1]3,000 | .... | .... | [2]5,300<br>[4]6,200 | .... | [1]1,400 | .... | .... | .... | .... |
|  | **Total** | **16,000** | **2,000** | **....** | **....** | **3,000** | **....** | **....** | **11,500** | **....** | **1,400** | **....** | **....** | **....** | **....** |
| **NIGERIA** | Kaduna Refinery & Petrochemical Co. (NNPC)–Kaduna[1] | 104,500 | 36,290 | .... | [1]18,000 | [2]15,300 | .... | .... | [1]21,600<br>[4]15,750<br>[7]536 | .... | [2]291 | 3,878 | 14,850 | .... | .... |
|  | Port Harcourt Refining Co. (NNPC)–Alesa Eleme | 60,000 | .... | .... | .... | [1]6,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Rivers State | 150,000 | 54,000 | .... | [1]40,000 | [6]33,000 | .... | .... | [1]33,000<br>[5]14,500 | [2]7,020<br>†*2,274 | [4]3,610 | .... | .... | .... | .... |
|  | Warri Refinery & Petrochemical Co. (NNPC)–Warri | 118,750 | 34,200 | .... | [1]24,700 | [2]15,770 | .... | .... | [2]15,770<br>[5]8,075 | [2]2,850 | .... | .... | .... | .... | .... |
|  | **Total** | **433,250** | **124,490** | **....** | **82,700** | **70,070** | **....** | **....** | **109,231** | **12,144** | **3,901** | **3,878** | **14,850** | **....** | **....** |
|  | Solvent extraction: [1]9,492 b/cd.<br>†Dimersol |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **NORWAY** | Esso Norge AS–Slagen-Toensberg | 90,000 | 4,000 | [3]28,000 | .... | [2]10,000 | .... | .... | [2]20,000<br>[5]9,000 | .... | .... | .... | 4,000 | .... | .... |
|  | Norske Shell AS–Sola | 53,000 | .... | [2]18,000 | .... | [2]11,000 | .... | .... | [1]17,500<br>[4]11,000 | .... | .... | .... | .... | .... | .... |
|  | Statoil Division Mongstad–Mongstad | 145,000 | .... | [5]22,000 | [2]41,000 | [2]10,000<br>[5]16,000 | .... | .... | [1]26,000<br>[5]16,900<br>[7]7,800 | *11,800 | [6]3,600 | .... | .... | .... | 469 |
|  | **Total** | **288,000** | **4,000** | **68,000** | **41,000** | **47,000** | **....** | **....** | **108,200** | **11,800** | **3,600** | **....** | **4,000** | **....** | **469** |
| **OMAN** | Oman Refinery Co.–Mina Al Fahal | **76,932** | **....** | **....** | **....** | **[2]15,386** | **....** | **....** | **[2]19,506** | **....** | **....** | **....** | **....** | **....** | **....** |
| **PAKISTAN** | Attock Refinery Ltd.–Rawalpindi | 30,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | National Refinery Ltd.–Korangi, Karachi[1] | 44,175 | 12,350 | .... | .... | [2]2,100 | .... | .... | [1]2,100<br>[5]9,358<br>[6]1,900 | .... | [1]504 | 3,563 | 3,800 | .... | .... |
|  | Pakistan Refinery Ltd.–Karachi | 46,300 | .... | .... | .... | [4]2,700 | .... | .... | [5]18,100 | .... | .... | .... | .... | .... | .... |
|  | **Total** | **120,975** | **12,350** | **....** | **....** | **4,800** | **....** | **....** | **31,458** | **....** | **504** | **3,563** | **3,800** | **....** | **....** |
|  | [1]Solvent Extraction: 5,605 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **PANAMA** | Refineria Panama SA–Las Minas | 100,000 | 14,000 | .... | .... | [2]7,500 | .... | .... | [1]10,000<br>[4]20,000 | .... | .... | .... | 5,000 | .... | .... |
|  | **Total** | **100,000** | **14,000** | **....** | **....** | **7,500** | **....** | **....** | **30,000** | **....** | **....** | **....** | **5,000** | **....** | **....** |
| **PARAGUAY** | Petroleos Paraguayos–Villa Elisa | **7,500** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** |
| **PERU** | Petróleos del Peru: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Conchan | 6,300 | 4,350 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 600 | .... | .... |
|  | Iquitos, Loreto | 10,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | La Pampilla, Lima | 105,000 | 12,000 | .... | [1]8,000 | [1]1,760 | .... | .... | .... | .... | .... | .... | .... | .... | .... |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/ day |
|  | Marsella, Loreto | 2,170 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Pucallpa | 2,850 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
|  | Talara | 62,000 | 22,800 | .... | $^{1}$16,600 | .... | .... | .... | .... | .... | .... | 1,200 | 600 | .... | .... |
|  | **Total** | **188,820** | **39,150** | .... | **24,600** | **1,760** | .... | .... | .... | .... | .... | **1,200** | **1,200** | .... | .... |
| **PHILIPPINES** | Caltex (Philippines) Inc.–Batangas. | 58,500 | 17,600 | .... | $^{1}$11,900 | $^{2}$5,700 | .... | .... | $^{1}$12,400<br>$^{4}$7,600 | .... | .... | .... | .... | .... | .... |
|  | Petron Corp.–Limay, Bataan | 155,000 | 32,000 | .... | $^{2}$15,000 | $^{1}$6,800<br>$^{2}$17,000 | .... | $^{4}$18,000 | $^{2}$52,000 | †*4,400 | .... | .... | 10,000 | .... | .... |
|  | Philippine Petroleum Corp.–Pililla | .... | 18,000 | .... | .... | .... | .... | .... | .... | .... | .... | 3,400 | .... | .... | .... |
|  | Pilipinas Shell Petroleum–Tabangao | 65,800 | .... | .... | .... | $^{1}$8,000 | .... | $^{2}$5,000 | $^{4}$14,000 | .... | .... | .... | .... | .... | .... |
|  | **Total** | **279,300** | **67,600** | .... | **26,900** | **37,500** | .... | **23,000** | **86,000** | **4,400** | .... | **3,400** | **10,000** | ... | ... |
|  | †* Polymerization Mothballed. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **POLAND** | Government-owned refineries at Czechowice, Glinik Mariampolski, Jasto, Jealicze, Kralaty, L. Warynski, Trzebinia. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Crude capacity | 73,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Mazovian Refinery & Petrochemical Works–Plock | 252,454 | 116,082 | .... | $^{1}$48,705 | $^{2}$31,186 | .... | .... | $^{1}$31,186<br>$^{5}$39,472 | $^{2}$4,353 | $^{1}$11,161<br>$^{2}$1,374 | 7,433 | .... | .... | .... |
|  | Petroleum Refinery Gdansk–Gdansk$^{1}$ | 60,000 | 29,500 | .... | .... | $^{4}$11,000 | .... | $^{4}$12,000 | $^{2}$23,500 | .... | .... | 5,500 | 8,000 | .... | .... |
|  | **Total** | **385,454** | **145,582** | .... | **48,705** | **42,186** | .... | **12,000** | **94,158** | **4,353** | **12,535** | **12,933** | **8,000** | .... | .... |
|  | Solvent extraction: $^{1}$6,800 b/cd. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **PORTUGAL** | Petrogal–Lisboa | .... | 18,900 | .... | $^{2}$10,100 | .... | .... | .... | .... | .... | .... | .... | 680 | .... | .... |
|  | Leça da Palmeira, Porto | 88,300 | 11,000 | .... | .... | $^{2}$15,600<br>$^{4}$10,500 | .... | .... | $^{1}$38,600<br>$^{4}$7,300<br>$^{6}$3,700 | .... | $^{1}$6,500 | 3,200 | 3,050 | .... | .... |
|  | Sines | 206,000 | 23,300 | .... | .... | $^{6}$24,900 | $^{4}$9,400 | $^{4}$28,800 | $^{1}$24,900 | .... | .... | .... | 2,500 | .... | .... |
|  | **Total** | **294,300** | **53,200** | .... | **10,100** | **51,000** | **9,400** | **28,800** | **74,500** | .... | **6,500** | **3,200** | **6,230** | .... | .... |
| **PUERTO RICO** | Caribbean Petroleum Corp.–Bayamón | 40,000 | 20,000 | .... | $^{1}$12,000 | $^{2}$6,500 | .... | .... | $^{1}$6,500<br>$^{4}$10,200 | *2,500 | .... | .... | 2,800 | .... | .... |
|  | Puerto Rico Sun Oil Co.–Yabucoa | 85,000 | 48,000 | .... | .... | $^{2}$19,000 | $^{3}$15,600 | .... | $^{1}$20,000<br>$^{4}$10,000 | .... | .... | 8,800 | .... | $^{1}$18.0 | .... |
|  | **Total** | **125,000** | **68,000** | .... | **12,000** | **25,500** | **15,600** | .... | **46,700** | **2,500** | .... | **8,800** | **2,800** | **18.0** | .... |
| **QATAR** | National Oil Distribution Co.–Umm Said | 62,000 | .... | .... | .... | $^{2}$2,200<br>$^{6}$9,830 | .... | $^{2}$12,000 | $^{2}$20,500 | .... | .... | .... | .... | .... | .... |
|  | **Total** | **62,000** | .... | .... | .... | **12,030** | .... | **12,000** | **20,500** | .... | .... | .... | .... | .... | .... |
| **ROMANIA** | Government-owned refineries at Bacau, Borzesti, Brazi, Brazov, Cimpina, Darmanesti, G. Gheorghiu Dej, Navodari, Onesti, Pitesti, Ploesti, Sulpacu, and Telaejen. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Total** | **617,000** |  |  |  |  |  |  |  |  |  |  |  |  |  |

| WORLDWIDE REFINING | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/day |
| **SAUDI ARABIA** | Saudi Arabian Oil Co. (Saudi Aramco)–Ras Tanura | 530,000 | 155,000 | .... | .... | $^{2}$50,000 | .... | .... | $^{1}$55,000 | .... | .... | .... | 13,000 | .... | .... |
| | Arabian Oil CL–Ras Al Khafji | 30,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Jeddah Oil Refinery–Jeddah | 82,000 | 15,700 | .... | $^{1}$9,041 | $^{2}$2,622 | .... | .... | .... | .... | .... | .... | 6,328 | .... | .... |
| | Petromin-Mobil–Yanbu | 300,000 | 118,200 | $^{3}$39,900 | $^{1}$78,500 | $^{5}$43,300 | .... | .... | $^{1}$65,800<br>$^{4}$84,500 | $^{2}$15,100 | $^{5}$28,100 | .... | .... | .... | .... |
| | Petromin Petrola Rabigh Refinery Co.—Rabigh | 332,500 | .... | .... | .... | .... | .... | $^{4}$44,650 | .... | .... | .... | .... | .... | $^{5}$12.0 | .... |
| | Petromin-Shell–Al-Jubail$^{1}$ | 284,000 | 84,000 | $^{3}$32,000 | .... | $^{6}$19,000 | $^{1}$45,000 | .... | $^{1}$19,000<br>$^{2}$61,000<br>$^{4}$50,000<br>$^{5}$49,000 | .... | $^{2}$7,100 | .... | .... | $^{1}$89.0 | .... |
| | Riyadh Oil Refinery–Riyadh$^{2}$ | 134,000 | 52,655 | .... | .... | $^{2}$28,600<br>$^{5}$5,400 | $^{2}$31,100 | .... | $^{2}$30,900<br>$^{4}$12,900 | .... | 8,000 | .... | 5,500 | $^{1}$117.0 | .... |
| | Yanbu Petromin Refinery–Yanbu | 170,000 | .... | .... | .... | $^{2}$35,000 | .... | .... | $^{1}$35,000<br>$^{4}$15,200 | .... | .... | .... | .... | .... | .... |
| | **Total** | **1,862,500** | **425,555** | **71,900** | **87,541** | **183,922** | **76,100** | **44,650** | **478,300** | **15,100** | **43,200** | **....** | **24,828** | **218.0** | **....** |

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Solvent extraction: $^{1}$14,000 b/cd. $^{2}$8,800 b/cd.

| WORLDWIDE REFINING | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SENEGAL** | Ste. Africaine de Raffinage–M'Bao (Dakar) | **24,000** | .... | .... | .... | **$^{4}$2,600** | .... | .... | **2,[illegible]00** | .... | .... | .... | .... | .... | .... |
| **SIERRA LEONE** | Sierra Leone Petroleum Refining Co.–Freetown | **10,000** | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **SINGAPORE** | BP Refinery Singapore PL–Pasir Panjang | 28,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Esso Singapore PL–Pulau Ayer Chawan | 190,000 | 39,000 | $^{3}$45,000 | .... | $^{2}$11,400 | .... | .... | $^{2}$22,300<br>$^{4}$38,000<br>$^{7}$17,100 | .... | .... | 8,100 | 4,000 | 2.6 | .... |
| | Mobil Oil Singapore PL–Jurong | 223,000 | 86,000 | $^{3}$53,000 | .... | $^{2}$18,000 | $^{1}$22,000 | $^{5}$11,000 | $^{1}$22,000<br>$^{4}$36,000 | .... | .... | .... | .... | .... | .... |
| | Shell Eastern Petroleum Ltd.–Pulau Bukom | 258,000 | 85,600 | $^{2}$64,700 | .... | $^{2}$6,800<br>$^{6}$13,900 | $^{1}$21,600 | $^{2}$44,600 | $^{2}$115,200 | .... | .... | 5,800 | 4,300 | $^{1}$40.0 | .... |
| | Singapore Petroleum CPL†–Pulau Merlimau | 179,000 | 60,600 | $^{3}$28,000 | .... | $^{4}$13,500 | $^{1}$10,400<br>$^{4}$17,000 | $^{4}$36,000 | $^{1}$11,000 | .... | .... | .... | 4,300 | $^{2}$18.0<br>$^{4}$14.0<br>$^{5}$7.0 | .... |
| | **Total** | **878,000** | **271,200** | **190,700** | **....** | **63,600** | **71,000** | **91,600** | **261,600** | **....** | **....** | **13,900** | **12,600** | **81.6** | **....** |

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†Singapore Petroleum CPL shares percentages of refinery capacities.

| WORLDWIDE REFINING | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/isomerization | Lubes | Asphalt | Hydrogen, MMcfd | Coke tons/day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SOMALIA** | Iraqsoma Ref. Co.–Mogadishu | **10,000** | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **SOUTH AFRICA** | Caltex Oil SA PL–Cape Town | 90,000 | 44,000 | $^{3}$9,500 | $^{1}$25,000 | $^{2}$10,500 | .... | $^{4}$22,300 | $^{1}$14,250 | .... | .... | .... | 1,140 | .... | .... |
| | Gencor–Durban | 65,000 | 32,000 | $^{3}$11,000 | $^{1}$15,000 | $^{2}$15,000 | .... | .... | $^{1}$21,000<br>$^{5}$28,000 | $^{2}$2,200 | $^{4\text{-}6}$6,000 | 3,000 | 4,000 | .... | .... |
| | National Petroleum Refiners of South Africa PL–Sasolburg OFS | 75,500 | 26,000 | $^{3}$8,500 | $^{1}$17,400 | $^{2}$11,100 | $^{1}$10,500<br>$^{3}$9,500 | .... | $^{1}$11,100<br>$^{7}$10,500 | $^{3}$3,000 | .... | .... | .... | $^{1}$27.5 | .... |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
|  | Shell and BP South Africa Petroleum Refineries PL–Durban | 200,000 | .... | [3]43,000 | [1]27,000 | [2]26,000 | .... | [4]55,000 | [4]57,000 | .... | .... | .... | .... | .... | .... |
|  | **Total** | **430,500** | **102,000** | **72,000** | **84,400** | **62,600** | **20,000** | **77,300** | **141,850** | **5,200** | **6,000** | **3,000** | **5,140** | **27.5** | **....** |
| **SPAIN** | Asfaltos Españoles SA–Tarragona. | 21,000 | 16,800 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 15,000 | .... | .... |
|  | Cia. Española de Petróles–San Roque (Cádiz) | 160,000 | 40,000 | [3]35,000 | [1]36,000 | [2]35,000 | .... | .... | [4]24,000<br>[5]15,000 | .... | [1]12,500<br>[2]1,800 | .... | .... | .... | .... |
|  | Tenerife | 130,000 | 12,000 | [3]35,000 | .... | [2]14,000 | .... | .... | [1]15,000<br>[3]20,000 | .... | .... | .... | 8,000 | .... | .... |
|  | Ertoil, SA–La Rábida, Huelva | 80,000 | 25,000 | [3]10,000 | .... | [2]14,100 | .... | .... | [1]14,100<br>[4]12,500<br>[6]2,800 | .... | [1]2,420<br>[2]3,500<br>[3]1,800 | 1,900 | 6,900 | [1]25.0<br>[5]6.0 | .... |
|  | Petrómed—Castellón de la Plana | 120,000 | 32,400 | .... | [1]23,300 | [2]13,400 | .... | .... | [1]13,400<br>[2]12,100<br>[4]36,200 | .... | .... | .... | 3,665 | .... | .... |
|  | Petronor SA–Somorrostro, Vizcaya | 240,000 | 90,000 | [3]40,000 | [1]40,000 | [2]33,500 | .... | [3]35,000<br>[4]40,000 | [1]45,000 | .... | .... | .... | 22,640 | [2]12.0 | .... |
|  | Repsol Petroleo SA– |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Cartagena, Murcia | 120,000 | 14,000 | .... | .... | [2]25,000 | .... | .... | .... | .... | .... | 3,000 | 5,000 | .... | .... |
|  | La Coruña | 135,000 | 29,000 | [5]13,500 | [1]28,000 | [2]22,000 | .... | .... | .... | .... | .... | .... | .... | .... | 550 |
|  | Puertollano, Ciudad Real | 135,000 | 62,000 | [5]16,000 | [1]30,000 | [2]18,000 | .... | .... | .... | .... | [1]1,800 | 2,800 | 6,000 | .... | 700 |
|  | Tarragona | 180,000 | 72,000 | [3]30,000 | .... | [2]16,000 | [1]15,000 | .... | .... | .... | .... | .... | .... | .... | .... |
|  | **Total** | **1,321,000** | **393,200** | **179,500** | **157,300** | **191,000** | **15,000** | **75,000** | **210,100** | **....** | **23,820** | **7,700** | **67,205** | **43.0** | **1,250** |
| **SRI LANKA** | Ceylon Petroleum Corp.–Sapugaskanda | 50,000 | 2,400 | [3]12,500 | .... | [2]3,750 | .... | [2]2,100 | [1]8,000<br>[4]7,300 | .... | .... | .... | 1,000 | .... | .... |
|  | **Total** | **50,000** | **2,400** | **12,500** | **....** | **3,750** | **....** | **2,100** | **15,300** | **....** | **....** | **....** | **1,000** | **....** | **....** |
| **SUDAN** | Port Sudan Refinery Ltd.–Port Sudan | 21,700 | .... | .... | .... | [1]1,900 | .... | .... | [4]8,100 | .... | .... | .... | .... | .... | .... |
| **SWEDEN** | AB Nynas Petroleum–Gothenburg | 12,500 | 9,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 8,500 | .... | .... |
|  | Nynäshamn | 28,000 | 31,000 | .... | .... | .... | .... | .... | [6]2,500 | .... | .... | 2,500 | 20,000 | [2]1.9 | .... |
|  | BP Raffinaderi–Gothenburg | 106,000 | .... | .... | .... | [2]20,500 | .... | .... | [4]45,000 | .... | .... | .... | .... | .... | .... |
|  | Shell Raffinaderi BV–Gothenburg | 81,000 | 30,000 | [2]25,000 | .... | [2]17,000 | .... | [2]17,000 | [2]28,000<br>[4]5,000 | .... | [6]4,000 | .... | .... | .... | .... |
|  | Skandinaviska Raffinaderi AB–Brofjorden-Lysekil | 200,000 | 65,000 | [3]40,000 | [1]25,000 | [4]34,500 | .... | [2]48,000 | [2]43,500<br>[4]30,500 | *3,500 | [6]12,000 | .... | .... | .... | .... |
|  | **Total** | **427,500** | **135,000** | **65,000** | **25,000** | **72,000** | **....** | **65,000** | **154,500** | **3,500** | **16,000** | **2,500** | **28,500** | **1.9** | **....** |
| **SWITZERLAND** | Raffinerie de Cressier SA–Cressier | 60,000 | 24,000 | [2]11,000<br>[3]9,000 | .... | [2]16,000 | .... | [2]8,000 | [1]27,000<br>[4]5,500 | .... | [6]3,600 | .... | 5,200 | .... | .... |
|  | Raffinerie du Sud-Ouest SA–Collombey | 72,000 | .... | .... | .... | [2]10,000 | .... | .... | [1]16,700 | .... | .... | .... | .... | .... | .... |
|  | **Total** | **132,000** | **24,000** | **20,000** | **....** | **26,000** | **....** | **8,000** | **49,200** | **....** | **3,600** | **....** | **5,200** | **....** | **....** |

| WORLDWIDE REFINING | Company and refinery location | Crude | Charge capacity, b/cd |  |  |  |  |  |  | Production capacity, b/cd |  |  |  |  | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **SYRIA** | Banias Refining Co.–Banias | 120,000 | 50,000 | $^{3}$25,000 | .... | $^{6}$20,000 | .... | $^{2}$35,000 | $^{2}$20,000 | .... | .... | .... | .... | .... | .... |
|  | Homs Refinery Co.–Homs | 117,394 | 7,245 | $^{5}$12,285 | .... | $^{2}$2,266<br>$^{6}$9,086 | .... | $^{2}$3,024<br>$^{4}$23,591 | $^{1}$15,412<br>$^{4}$6,720 | .... | $^{6}$2,850 | .... | 4,474 | $^{2}$9.9<br>$^{6}$11.9 | 530 |
|  | **Total** | **237,394** | **57,245** | **37,285** | **....** | **31,352** | **....** | **61,615** | **42,132** | **....** | **2,850** | **....** | **4,474** | **21.8** | **530** |
| **TAIWAN,** | Chinese Petroleum Corp.–Kaohsiung | 425,000 | 79,100 | $^{4}$3,933<br>$^{5}$13,560 | $^{1}$22,600 | $^{2}$18,080<br>$^{6}$18,080 | $^{1}$18,080 | $^{1}$27,120<br>$^{2}$27,120<br>$^{3}$22,600<br>$^{4}$13,560 | $^{1}$36,000<br>$^{5}$5,400<br>$^{7}$7,230 | $^{2}$3,200 | $^{1}$12,534<br>$^{2}$1,202<br>$^{3}$1,202 | 3,960 | 10,996 | $^{1}$35.0<br>$^{2}$50.0<br>$^{3}$45.0 | 1,050 |
|  | Tao-Yuan | 117,500 | 32,600 | .... | .... | $^{2}$15,800 | .... | $^{1}$40,680<br>$^{2}$18,080 | $^{1}$15,800<br>$^{4}$14,500 | .... | .... | .... | .... | $^{1}$62.0 | .... |
|  | **Total** | **542,500** | **111,700** | **17,493** | **22,600** | **51,960** | **18,080** | **149,160** | **78,930** | **3,325** | **14,938** | **....** | **10,996** | **192.0** | **1,050** |
| **TANZANIA** | Tanzanian & Italian Petroleum Refining CL–Kigamboni, Dar es Salaam | **17,000** | **....** | **....** | **....** | $^{2}$**6,700** | **....** | **....** | $^{2}$**5,000** | **....** | **....** | **....** | **....** | **....** | **....** |
| **THAILAND** | Esso Standard Thailand Ltd.–Sriracha | 75,000 | 6,200 | .... | .... | $^{5}$8,800 | .... | .... | $^{2}$19,400<br>$^{4}$11,900<br>$^{7}$11,100 | .... | .... | .... | 2,500 | .... | .... |
|  | Petroleum Authority of Thailand–Bangchak, Bangkok | 61,750 | .... | .... | .... | $^{2}$9,450 | .... | $^{5}$3,150 | $^{1}$4,950<br>$^{2}$5,850<br>$^{7}$16,200 | .... | .... | .... | .... | $^{1}$4.7 | .... |
|  | Thai Oil CL–Sriracha | 83,800 | 52,700 | $^{3}$17,600 | $^{1}$10,200<br>$^{2}$15,900 | $^{1}$2,700<br>$^{2}$6,600 | .... | $^{2}$9,100 | $^{2}$31,400 | .... | .... | .... | 1,600 | $^{1}$32.6 | .... |
|  | **Total** | **220,550** | **58,900** | **17,600** | **26,100** | **27,550** | **....** | **12,550** | **100,800** | **....** | **....** | **....** | **4,100** | **37.3** | **....** |
| **TRINIDAD** | Trinidad and Tobago Oil CL–Pointe-a-Pierre | 116,000 | 130,000 | $^{3}$8,000 | $^{1}$26,000 | $^{4}$8,700 | .... | .... | $^{1}$8,700<br>$^{5}$17,400 | $^{1}$1,400<br>*1,100 | $^{1}$1,700 | 2,700 | .... | .... | .... |
|  | Point Fortin | 80,000 | .... | .... | .... | $^{4}$5,700 | .... | $^{5}$4,000 | $^{5}$20,000 | .... | .... | .... | .... | .... | .... |
|  | **Total** | **246,000** | **130,000** | **8,000** | **26,000** | **14,400** | **....** | **4,000** | **46,100** | **2,500** | **1,700** | **2,700** | **....** | **....** | **....** |
| **TUNISIA** | Ste. Tunisienne Industries des Raffinage–Bizerte | **34,000** | **....** | **....** | **....** | **3,300** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** | **....** |
| **TURKEY** | Anadolu Tasfiyehanesi AS–Mersin. | 90,000 | .... | .... | .... | $^{2}$12,000 | .... | .... | $^{1}$22,360<br>$^{4}$10,320 | .... | .... | .... | .... | .... | .... |
|  | Turkish Petroleum Refineries Corp.–Aliaga, Izmir[1] | 234,120 | 37,740 | .... | $^{1}$15,100 | $^{2}$12,830 | .... | .... | $^{1}$15,096<br>$^{3}$9,057 | .... | .... | 4,000 | 10,000 | $^{6}$0.4 | .... |
|  | Batman, Siirt | 24,350 | 4,140 | $^{2}$4,177 | .... | $^{2}$1,300 | .... | .... | $^{1}$1,300 | .... | .... | .... | 4,140 | .... | .... |
|  | Izmit | 267,325 | 84,915 | .... | $^{1}$25,475 | $^{2}$20,085 | .... | .... | $^{1}$20,443<br>$^{4}$22,015<br>$^{5}$20,757 | .... | .... | .... | 8,800 | .... | .... |
|  | Kirikkale | 112,849 | 29,563 | .... | .... | $^{2}$20,342 | .... | $^{4}$15,096 | $^{1}$20,342<br>$^{2}$8,825 | .... | .... | .... | 6,177 | .... | .... |
|  | **Total** | **728,644** | **156,358** | **4,177** | **40,575** | **66,557** | **....** | **15,096** | **150,515** | **....** | **....** | **4,000** | **29,117** | **0.4** | **....** |

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Solvent extraction: [1] 11,700 b/cd (furfural), 6,700 b/cd (propane deasphalting).

| WORLDWIDE REFINING | | Company and refinery location | | Charge capacity, b/cd | | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydrocracking | Cat hydrorefining | Cat hydrotreating | Alky. *Poly. | Aromatics/ Isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **UNITED KINGDOM** | **England** | Conoco Ltd.–South Killingholme .... | 130,000 | 112,000 | $^{2}$40,000<br>$^{5}$54,000 | $^{1}$45,000 | $^{2}$53,000 | .... | .... | $^{4}$80,000<br>$^{5}$45,000<br>$^{7}$30,000 | $^{2}$11,000<br>*3,500 | $^{1}$3,000<br>$^{6}$19,000 | .... | .... | .... | 2,150 |
| | | Eastham Refinery Ltd.–Eastham, Cheshire.......... | 12,000 | 10,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 8,000 | .... | .... |
| | | Ellesmere Port.......... | 22,000 | 19,250 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 15,000 | .... | .... |
| | | Esso Petroleum CL–Fawley .......... | 300,200 | 120,840 | .... | $^{1}$76,500 | $^{2}$27,900<br>$^{4}$22,500 | .... | .... | $^{1\text{-}2}$73,260<br>$^{4\text{-}5}$104,130<br>$^{6}$7,200 | *12,600 | $^{6}$16,150 | 7,200 | 7,650 | .... | .... |
| | | Lindsey Oil Refinery Ltd.–Killingholm, South Humberside... | 190,000 | 80,000 | $^{3}$26,000 | $^{1}$40,000 | $^{2}$33,600 | .... | $^{4}$40,600 | $^{1\text{-}2}$45,400<br>$^{3}$3,600 | $^{2}$4,100<br>*1,900 | .... | .... | 7,100 | .... | .... |
| | | Mobil Oil GL–Coryton, Essex .......... | 152,000 | 86,000 | .... | $^{1}$52,000 | $^{4}$32,000 | .... | .... | $^{1}$41,000<br>$^{3}$14,000 | $^{2}$16,000 | $^{4}$8,500 | 5,500 | 1,700 | .... | .... |
| | | Phillips Imperial Petroleum Ltd.–Port Clarence.......... | 100,000 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | Shell U.K. Ltd.–Shell Haven.......... | 92,000 | 30,000 | .... | .... | $^{6}$32,000 | $^{1}$22,000 | .... | $^{1}$34,000<br>$^{4}$29,000 | .... | .... | .... | 3,000 | .... | .... |
| | | Stanlow .......... | 262,000 | 90,000 | .... | $^{1}$59,000 | $^{2}$29,000<br>$^{6}$27,000 | .... | $^{2}$41,000 | $^{1}$56,000<br>$^{2}$14,000 | $^{2}$8,300 | $^{1}$9,000<br>$^{2}$5,000 | 4,500 | 8,000 | .... | .... |
| | | **Total** .......... | **1,260,200** | **548,590** | **120,000** | **272,500** | **257,000** | **22,000** | **81,600** | **576,590** | **57,400** | **60,650** | **17,200** | **50,450** | **....** | **2,150** |
| | **Scotland** | BP Refinery Grangemouth Ltd.–Grangemouth.......... | 198,500 | 67,800 | .... | $^{1}$21,000 | $^{2}$32,000 | $^{1}$32,000 | .... | $^{1\text{-}2}$69,000 | $^{2}$4,200 | .... | .... | .... | $^{1}$42.5<br>$^{4}$52.8 | .... |
| | | Briggs Oil Ltd.—Dundee .......... | 10,240 | 9,600 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 6,950 | .... | .... |
| | | **Total** .......... | **208,740** | **77,400** | **....** | **21,000** | **32,000** | **32,000** | **....** | **69,000** | **4,200** | **....** | **....** | **6,950** | **95.3** | **....** |
| | **Wales** | BP Refinery Llandarcy Ltd.–Llandarcy, Neath .......... | .... | 27,000 | .... | .... | .... | .... | .... | .... | .... | .... | 4,400 | .... | .... | .... |
| | | Elf Oil (G.B.) Ltd.–Milford Haven ... | 108,000 | 55,000 | .... | $^{1}$32,500 | $^{2}$17,800 | .... | .... | $^{2}$17,800<br>$^{4}$30,000 | $^{2}$3,300<br>*1,300 | .... | .... | .... | .... | .... |
| | | Gulf Oil-GB–Milford Haven .......... | 110,000 | 45,000 | .... | $^{1}$28,500 | $^{2}$20,500 | .... | .... | $^{1}$33,000<br>$^{2}$22,000<br>$^{3}$33,000 | $^{2}$7,400 | .... | .... | .... | $^{5}$2.0 | .... |
| | | Pembroke Cracking Co. (65% Texaco, 35% Gulf Oil-GB)–Milford Haven .......... | .... | .... | .... | $^{1}$90,000 | .... | .... | .... | $^{7}$29,000 | $^{2}$29,000 | $^{4}$14,000 | .... | .... | $^{5}$0.9 | .... |
| | | Texaco Ltd.–Pembroke, Dyfed.......... | 180,000 | 91,000 | $^{3}$26,000 | .... | $^{6}$39,000 | .... | $^{4}$34,000 | $^{1}$39,000 | .... | .... | .... | .... | .... | .... |
| | | **Total** .......... | **398,000** | **218,000** | **26,000** | **151,000** | **77,300** | **....** | **34,000** | **200,500** | **41,000** | **14,000** | **4,400** | **....** | **2.9** | **....** |
| | | **Total United Kingdom** .......... | **1,866,940** | **843,990** | **146,000** | **444,500** | **366,300** | **54,000** | **115,600** | **846,090** | **102,600** | **74,650** | **21,600** | **57,400** | **98.2** | **2,150** |
| **URUGUAY** | | Ancap–La Teja, Montevideo.......... | **33,000** | **13,000** | **....** | **$^{1}$4,100** | **$^{1}$2,500** | **....** | **....** | **$^{4}$3,700** | **....** | **....** | **....** | **....** | **....** | **....** |
| **U.S.S.R.** | | Government-owned refineries at Achinsk, Angarsk, Baku, Batumi, Chimkent, Drogobych, Fergana, Gorki, Grozny, Guryev, Ishimbai, Khabarovsk, Kherson, Kirishi, Komsomolsk, Krasnovodsk, Kremenchug, Kuibyshev, Lisichansk, Mazheikiai, Moscow, Mozyr, Nadvornaya, Nizhnekamsk, Odessa, Omsk, Orsk, Pavlodar, Perm, Polotsk, Ryazan, Saratov, Syzran, Tuapse, Ufa, Ukhta, Vannovskiy, Volgograd, and Yaroslavl. | | | | | | | | | | | | | | |
| | | **Total** .......... | **12,300,000** | | | | | | | | | | | | | |

| WORLDWIDE REFINING | | | Charge capacity, b/cd | | | | | | | Production capacity, b/cd | | | | | Coke |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company and refinery location | Crude | Vacuum distillation | Thermal operations | Catalytic cracking | Cat reforming | Cat hydro-cracking | Cat hydro-refining | Cat hydro-treating | Alky. *Poly. | Aromatics/ isomerization | Lubes | Asphalt | Hydrogen, MMcfd | tons/ day |
| **VENEZUELA** | Corpoven–El Palito, Carabobo | 105,000 | 63,000 | .... | [1]41,000 | [2]6,000 | .... | .... | .... | [2]20,000 | [1]5,000 | .... | .... | .... | .... |
| | El Toreño, Barinas | 4,800 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Puerto La Cruz, Anzoategui | 195,000 | .... | .... | [1]12,000 | .... | .... | .... | .... | [2]2,200 | .... | .... | .... | .... | .... |
| | San Roque, Anzoategui | 5,200 | 1,770 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Lagoven–Judibana, Falcon | 571,000 | 336,000 | [6]52,100 | [1]26,500 | .... | .... | [2]149,000<br>[4]63,000 | [6]700 | [2]17,800 | [4]9,800 | 2,100 | 40,000 | [1]81.0 | 100 |
| | Maraven–Punta Cardon, Falcon | 286,000 | 147,600 | [3]82,000 | [1]59,500 | .... | .... | [2]31,100<br>[3]32,300<br>[5]2,300 | .... | [2]22,800 | [4]9,500 | 6,000 | .... | [1]24.0 | .... |
| | **Total** | **1,167,000** | **548,370** | **134,100** | **139,000** | **6,000** | **....** | **277,700** | **700** | **62,800** | **24,300** | **8,100** | **40,000** | **105.0** | **100** |
| **VIRGIN ISLANDS** | Hess Oil Virgin Islands Corp.–St. Croix | 545,000 | 215,000 | [3]80,000 | .... | [2]125,000 | .... | [2]130,000 | [2]125,000<br>[4]165,000 | .... | [1]30,000<br>[5]15,000 | .... | .... | .... | .... |
| | **Total** | **545,000** | **215,000** | **80,000** | **....** | **125,000** | **....** | **130,000** | **290,000** | **....** | **45,000** | **....** | **....** | **....** | **....** |
| **YEMEN** | Aden Refinery Co.–Little Aden[1] | 161,500 | 9,500 | .... | .... | [1]10,800 | .... | [4]2,700 | .... | .... | .... | .... | 2,000 | .... | .... |
| | Yemen Hunt Oil Co.–Marib | 10,000 | .... | .... | .... | [1]2,500 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | **Total** | **171,500** | **9,500** | **....** | **....** | **13,300** | **....** | **2,700** | **....** | **....** | **....** | **....** | **2,000** | **....** | **....** |
| | Solvent extraction! [1]7,920 b/cd. | | | | | | | | | | | | | | |
| **YUGOSLAVIA** | Bosanski Brod[1] | 112,835 | 44,609 | .... | .... | [2]7,612<br>[6]13,500 | [3]7,200 | .... | [1]20,200<br>[4]13,438 | .... | .... | .... | 13,310 | [1]14.0 | .... |
| | Lendava | 14,600 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | Novi Sad | 63,000 | 30,000 | .... | .... | [2]8,200 | .... | [4]4,600 | [1]10,700<br>[4]4,400<br>[6]4,600 | .... | .... | 1,500 | 4,000 | [1]0.5 | .... |
| | Pancevo | 108,000 | 44,850 | [3]21,700 | [1]20,750 | [2]8,800 | .... | [4]5,000<br>[5]9,370 | [1]8,800 | [1]3,400 | [1]215 | .... | 6,300 | .... | .... |
| | Rijeka | 160,000 | 43,000 | [2]8,000 | [1]21,300 | [2]17,500 | .... | [4]3,000 | [1]17,500<br>[6]5,000 | .... | [1]2,800<br>[2]420<br>[6]9,000 | 2,200 | .... | [1]0.4 | .... |
| | Sisak | 150,000 | 15,700 | [5]5,930 | [2]10,000 | [2]19,000 | .... | .... | [1]16,900<br>[3]3,640<br>[5]2,700 | .... | [1]4,900 | .... | .... | .... | 137 |
| | Zagreb | 700 | 600 | .... | .... | .... | .... | .... | .... | .... | .... | 1,200 | .... | .... | .... |
| | **Total** | **609,135** | **178,759** | **35,630** | **52,050** | **74,612** | **7,200** | **21,970** | **107,878** | **3,400** | **17,335** | **4,900** | **23,610** | **14.9** | **137** |
| | Solvent extraction: [1]3,300 b/cd (deasphalting). | | | | | | | | | | | | | | |
| **ZAIRE** | Sozir–Muanda | **17,000** | **....** | **....** | **....** | **[2]3,500** | **....** | **....** | **[2]5,000** | **....** | **....** | **....** | **....** | **....** | **....** |
| **ZAMBIA** | **Indeni Petroleum Refinery CL–Bwana Nkubwa Area, Ndola** | **24,500** | **2,400** | **....** | **....** | **[2]5,600** | **....** | **....** | **[4]9,000** | **....** | **....** | **....** | **....** | **....** | **....** |

## Baker Hughes rig count

| | 1-29-90 | 1-30-89 |
|---|---|---|
| Alabama | 14 | 10 |
| Alaska | 10 | 12 |
| Arkansas | 9 | 6 |
| California | 40 | 44 |
| Land | 34 | 35 |
| Offshore | 6 | 9 |
| Colorado | 23 | 18 |
| Florida | 4 | 1 |
| Illinois | 4 | 4 |
| Indiana | 0 | 0 |
| Kansas | 46 | 38 |
| Kentucky | 8 | 5 |
| Louisiana | 139 | 129 |
| N. Land | 18 | 12 |
| S. Inland Waters | 19 | 13 |
| S. Land | 36 | 34 |
| Offshore | 66 | 70 |
| Maryland | 0 | 0 |
| Michigan | 17 | 13 |
| Mississippi | 14 | 27 |
| Montana | 3 | 2 |
| Nebraska | 2 | 1 |
| New Mexico | 43 | 25 |
| New York | 1 | 2 |
| North Dakota | 18 | 10 |
| Ohio | 18 | 22 |
| Oklahoma | 121 | 132 |
| Pennsylvania | 15 | 26 |
| South Dakota | 1 | 1 |
| Texas | 320 | 228 |
| Offshore | 22 | 19 |
| Inland Waters | 0 | 1 |
| Dist. 1 | 34 | 0 |
| Dist. 2 | 11 | 8 |
| Dist. 3 | 34 | 28 |
| Dist. 4 | 38 | 33 |
| Dist. 5 | 19 | 7 |
| Dist. 6 | 34 | 38 |
| Dist. 7B | 16 | 7 |
| Dist. 7C | 20 | 12 |
| Dist. 8 | 45 | 25 |
| Dist. 8A | 21 | 19 |
| Dist. 9 | 20 | 21 |
| Dist. 10 | 6 | 10 |
| Utah | 2 | 4 |
| West Virginia | 20 | 12 |
| Wyoming | 40 | 20 |
| Others, Hi.-1,Tn.-1, Va.-3 | 5 | 5 |
| **Total U.S.** | **937** | **797** |
| **Cum. Avg. to Date** | **998** | **841** |
| Canada | 205 | 162 |
| Canada-Offshore | 0 | 1 |
| **Grand Total** | **1,142** | **960** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 482** **Gas Rigs — 447**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 2-26-90 | 2-27-89 |
|---|---|---|
| Alabama | 10 | 8 |
| Alaska | 11 | 9 |
| Arkansas | 6 | 7 |
| California | 38 | 43 |
| Land | 34 | 35 |
| Offshore | 4 | 8 |
| Colorado | 26 | 18 |
| Florida | 3 | 3 |
| Illinois | 4 | 4 |
| Indiana | 0 | 0 |
| Kansas | 44 | 36 |
| Kentucky | 7 | 1 |
| Louisiana | 148 | 126 |
| N. Land | 18 | 15 |
| S. Inland Waters | 17 | 17 |
| S. Land | 39 | 32 |
| Offshore | 74 | 62 |
| Maryland | 0 | 0 |
| Michigan | 13 | 19 |
| Mississippi | 14 | 25 |
| Montana | 2 | 5 |
| Nebraska | 1 | 3 |
| New Mexico | 35 | 24 |
| New York | 1 | 4 |
| North Dakota | 18 | 12 |
| Ohio | 17 | 16 |
| Oklahoma | 111 | 113 |
| Pennsylvania | 15 | 25 |
| South Dakota | 0 | 1 |
| Texas | 328 | 218 |
| Offshore | 22 | 18 |
| Inland Waters | 0 | 1 |
| Dist. 1 | 43 | 2 |
| Dist. 2 | 9 | 11 |
| Dist. 3 | 36 | 24 |
| Dist. 4 | 41 | 29 |
| Dist. 5 | 18 | 6 |
| Dist. 6 | 39 | 29 |
| Dist. 7B | 10 | 8 |
| Dist. 7C | 23 | 15 |
| Dist. 8 | 42 | 29 |
| Dist. 8A | 21 | 21 |
| Dist. 9 | 14 | 16 |
| Dist. 10 | 10 | 9 |
| Utah | 3 | 3 |
| West Virginia | 10 | 11 |
| Wyoming | 26 | 19 |
| Others, Hi.-2,Va.-4 | 6 | 4 |
| **Total U.S.** | **897** | **757** |
| **Cum. Avg. to Date** | **959** | **806** |
| Canada | 230 | 226 |
| Canada-Offshore | 0 | 1 |
| **Grand Total** | **1,127** | **984** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 485** **Gas Rigs — 405**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 3-26-90 | 3-27-89 |
|---|---|---|
| Alabama | 15 | 8 |
| Alaska | 15 | 11 |
| Arkansas | 9 | 4 |
| California | 35 | 54 |
| Land | 32 | 47 |
| Offshore | 3 | 7 |
| Colorado | 24 | 18 |
| Florida | 2 | 1 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 43 | 41 |
| Kentucky | 7 | 4 |
| Louisiana | 138 | 128 |
| N. Land | 17 | 10 |
| S. Inland Waters | 12 | 18 |
| S. Land | 39 | 39 |
| Offshore | 70 | 61 |
| Maryland | 0 | 0 |
| Michigan | 15 | 17 |
| Mississippi | 11 | 17 |
| Montana | 3 | 7 |
| Nebraska | 1 | 1 |
| New Mexico | 33 | 28 |
| New York | 1 | 2 |
| North Dakota | 20 | 12 |
| Ohio | 13 | 8 |
| Oklahoma | 106 | 118 |
| Pennsylvania | 18 | 14 |
| South Dakota | 0 | 0 |
| Texas | 333 | 234 |
| Offshore | 24 | 21 |
| Inland Waters | 1 | 1 |
| Dist. 1 | 48 | 2 |
| Dist. 2 | 11 | 8 |
| Dist. 3 | 36 | 24 |
| Dist. 4 | 46 | 33 |
| Dist. 5 | 13 | 7 |
| Dist. 6 | 36 | 31 |
| Dist. 7B | 15 | 14 |
| Dist. 7C | 19 | 17 |
| Dist. 8 | 43 | 31 |
| Dist. 8A | 18 | 23 |
| Dist. 9 | 12 | 11 |
| Dist. 10 | 11 | 11 |
| Utah | 4 | 5 |
| West Virginia | 15 | 6 |
| Wyoming | 23 | 19 |
| Others, Hi. −2,Nv. −1 Va. −2 | 5 | 4 |
| **Total U.S.** | **893** | **766** |
| **Cum. Avg. to Date** | **942** | **789** |
| Canada | 189 | 212 |
| Canada-Offshore | 1 | 2 |
| **Grand Total** | **1,083** | **980** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 474** **Gas Rigs — 414**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 4-30-90 | 5-1-89 |
|---|---|---|
| Alabama | 21 | 10 |
| Alaska | 11 | 11 |
| Arkansas | 14 | 5 |
| California | 42 | 50 |
| Land | 39 | 45 |
| Offshore | 3 | 5 |
| Colorado | 20 | 19 |
| Florida | 2 | 2 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 53 | 38 |
| Kentucky | 7 | 3 |
| Louisiana | 146 | 136 |
| N. Land | 16 | 20 |
| S. Inland Waters | 18 | 17 |
| S. Land | 37 | 43 |
| Offshore | 75 | 56 |
| Maryland | 0 | 0 |
| Michigan | 10 | 8 |
| Mississippi | 11 | 14 |
| Montana | 5 | 6 |
| Nebraska | 0 | 2 |
| New Mexico | 45 | 35 |
| New York | 0 | 0 |
| North Dakota | 20 | 10 |
| Ohio | 5 | 4 |
| Oklahoma | 119 | 124 |
| Pennsylvania | 8 | 2 |
| South Dakota | 0 | 1 |
| Texas | 336 | 230 |
| Offshore | 27 | 22 |
| Inland Waters | 0 | 1 |
| Dist. 1 | 48 | 2 |
| Dist. 2 | 9 | 7 |
| Dist. 3 | 39 | 20 |
| Dist. 4 | 42 | 31 |
| Dist. 5 | 15 | 7 |
| Dist. 6 | 34 | 38 |
| Dist. 7B | 8 | 17 |
| Dist. 7C | 30 | 14 |
| Dist. 8 | 35 | 25 |
| Dist. 8A | 31 | 20 |
| Dist. 9 | 9 | 14 |
| Dist. 10 | 9 | 12 |
| Utah | 5 | 2 |
| West Virginia | 14 | 10 |
| Wyoming | 22 | 18 |
| Others, HI. −2,NV. −1 VA. −4 | 7 | 6 |
| **Total U.S.** | **927** | **751** |
| **Cum. Avg. to Date** | **940** | **783** |
| Canada | 52 | 52 |
| Canada-Offshore | 0 | 2 |
| **Grand Total** | **979** | **805** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 472** **Gas Rigs — 451**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 5-28-90 | 5-29-89 |
|---|---|---|
| Alabama | 26 | 8 |
| Alaska | 9 | 9 |
| Arkansas | 7 | 6 |
| California | 58 | 51 |
| Land | 55 | 47 |
| Offshore | 3 | 4 |
| Colorado | 29 | 20 |
| Florida | 2 | 2 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 50 | 40 |
| Kentucky | 12 | 5 |
| Louisiana | 165 | 134 |
| N. Land | 19 | 12 |
| S. Inland Waters | 22 | 18 |
| S. Land | 44 | 32 |
| Offshore | 80 | 72 |
| Maryland | 0 | 0 |
| Michigan | 15 | 14 |
| Mississippi | 12 | 17 |
| Montana | 2 | 5 |
| Nebraska | 1 | 3 |
| New Mexico | 50 | 34 |
| New York | 0 | 0 |
| North Dakota | 25 | 16 |
| Ohio | 10 | 6 |
| Oklahoma | 117 | 99 |
| Pennsylvania | 10 | 5 |
| South Dakota | 0 | 1 |
| Texas | 342 | 225 |
| Offshore | 26 | 18 |
| Inland Waters | 0 | 2 |
| Dist. 1 | 59 | 6 |
| Dist. 2 | 8 | 12 |
| Dist. 3 | 31 | 25 |
| Dist. 4 | 40 | 30 |
| Dist. 5 | 13 | 4 |
| Dist. 6 | 39 | 35 |
| Dist. 7B | 9 | 7 |
| Dist. 7C | 28 | 15 |
| Dist. 8 | 39 | 26 |
| Dist. 8A | 29 | 25 |
| Dist. 9 | 11 | 11 |
| Dist. 10 | 10 | 9 |
| Utah | 3 | 2 |
| West Virginia | 12 | 14 |
| Wyoming | 34 | 21 |
| Others, HI. −2,NV. −3 VA. −1 | 6 | 7 |
| **Total U.S.** | **1,001** | **749** |
| **Cum. Avg. to Date** | **944** | **778** |
| Canada | 64 | 73 |
| Canada-Offshore | 1 | 0 |
| **Grand Total** | **1,066** | **822** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 514** **Gas Rigs — 485**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 6-25-90 | 6-26-89 |
|---|---|---|
| Alabama | 33 | 14 |
| Alaska | 10 | 9 |
| Arkansas | 6 | 8 |
| California | 47 | 44 |
| Land | 43 | 41 |
| Offshore | 4 | 3 |
| Colorado | 31 | 24 |
| Florida | 2 | 2 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 48 | 40 |
| Kentucky | 8 | 4 |
| Louisiana | 166 | 136 |
| N. Land | 24 | 12 |
| S. Inland Waters | 21 | 15 |
| S. Land | 36 | 30 |
| Offshore | 85 | 79 |
| Maryland | 0 | 0 |
| Michigan | 16 | 17 |
| Mississippi | 15 | 15 |
| Montana | 4 | 3 |
| Nebraska | 5 | 2 |
| New Mexico | 51 | 41 |
| New York | 0 | 0 |
| North Dakota | 22 | 20 |
| Ohio | 11 | 9 |
| Oklahoma | 127 | 100 |
| Pennsylvania | 18 | 18 |
| South Dakota | 1 | 0 |
| Texas | 333 | 240 |
| Offshore | 20 | 20 |
| Inland Waters | 1 | 2 |
| Dist. 1 | 60 | 6 |
| Dist. 2 | 8 | 12 |
| Dist. 3 | 28 | 32 |
| Dist. 4 | 46 | 29 |
| Dist. 5 | 11 | 4 |
| Dist. 6 | 36 | 35 |
| Dist. 7B | 10 | 11 |
| Dist. 7C | 24 | 10 |
| Dist. 8 | 38 | 33 |
| Dist. 8A | 31 | 21 |
| Dist. 9 | 14 | 13 |
| Dist. 10 | 6 | 12 |
| Utah | 3 | 5 |
| West Virginia | 17 | 18 |
| Wyoming | 37 | 28 |
| Others, HI. −1,NV. −4 VA. −1 | 6 | 8 |
| **Total U.S.** | **1,021** | **810** |
| **Cum. Avg. to Date** | **952** | **780** |
| Canada | 94 | 120 |
| Canada-Offshore | 0 | 1 |
| **Grand Total** | **1,115** | **931** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 496** **Gas Rigs — 516**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 7-30-90 | 7-31-89 |
|---|---|---|
| Alabama | 30 | 13 |
| Alaska | 10 | 12 |
| Arkansas | 10 | 11 |
| California | 52 | 51 |
| Land | 47 | 47 |
| Offshore | 5 | 4 |
| Colorado | 36 | 32 |
| Florida | 2 | 2 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 42 | 43 |
| Kentucky | 11 | 6 |
| Louisiana | 140 | 144 |
| N. Land | 14 | 14 |
| S. Inland Waters | 20 | 21 |
| S. Land | 30 | 28 |
| Offshore | 76 | 81 |
| Maryland | 0 | 0 |
| Michigan | 15 | 21 |
| Mississippi | 16 | 15 |
| Montana | 6 | 5 |
| Nebraska | 3 | 1 |
| New Mexico | 48 | 34 |
| New York | 3 | 0 |
| North Dakota | 20 | 9 |
| Ohio | 14 | 11 |
| Oklahoma | 134 | 112 |
| Pennsylvania | 15 | 20 |

| | 7-30-90 | 7-31-89 |
|---|---|---|
| South Dakota | 0 | 0 |
| Texas | 322 | 246 |
| Offshore | 16 | 24 |
| Inland Waters | 1 | 2 |
| Dist. 1 | 69 | 10 |
| Dist. 2 | 11 | 9 |
| Dist. 3 | 39 | 25 |
| Dist. 4 | 44 | 33 |
| Dist. 5 | 11 | 12 |
| Dist. 6 | 31 | 46 |
| Dist. 7B | 11 | 8 |
| Dist. 7C | 11 | 10 |
| Dist. 8 | 34 | 29 |
| Dist. 8A | 19 | 24 |
| Dist. 9 | 15 | 8 |
| Dist. 10 | 10 | 6 |
| Utah | 6 | 6 |
| West Virginia | 15 | 21 |
| Wyoming | 37 | 42 |
| Others, HI. – 1, NV. – 3 VA. – 1 | 5 | 8 |
| **Total U.S.** | **996** | **870** |
| **Cum. Avg. to Date** | **961** | **769** |
| Canada | 122 | 110 |
| Canada-Offshore | 0 | 2 |
| **Grand Total** | **1,118** | **982** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 588** **Gas Rigs — 466**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 8-27-90 | 8-28-89 |
|---|---|---|
| Alabama | 38 | 9 |
| Alaska | 10 | 13 |
| Arkansas | 11 | 14 |
| California | 54 | 53 |
| Land | 49 | 48 |
| Offshore | 5 | 5 |
| Colorado | 24 | 28 |
| Florida | 1 | 1 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 37 | 42 |
| Kentucky | 8 | 7 |
| Louisiana | 151 | 143 |
| N. Land | 19 | 21 |
| S. Inland Waters | 23 | 18 |
| S. Land | 31 | 31 |
| Offshore | 78 | 73 |
| Maryland | 0 | 0 |
| Michigan | 8 | 22 |
| Mississippi | 17 | 18 |
| Montana | 6 | 7 |
| Nebraska | 3 | 2 |
| New Mexico | 43 | 31 |
| New York | 2 | 0 |
| North Dakota | 24 | 13 |
| Ohio | 10 | 13 |
| Oklahoma | 126 | 117 |
| Pennsylvania | 21 | 22 |

| | 8-27-90 | 8-28-89 |
|---|---|---|
| South Dakota | 1 | 1 |
| Texas | 336 | 265 |
| Offshore | 21 | 18 |
| Inland Waters | 1 | 4 |
| Dist. 1 | 69 | 7 |
| Dist. 2 | 9 | 14 |
| Dist. 3 | 37 | 25 |
| Dist. 4 | 48 | 37 |
| Dist. 5 | 9 | 5 |
| Dist. 6 | 32 | 54 |
| Dist. 7B | 9 | 8 |
| Dist. 7C | 18 | 13 |
| Dist. 8 | 27 | 34 |
| Dist. 8A | 31 | 21 |
| Dist. 9 | 12 | 12 |
| Dist. 10 | 13 | 13 |
| Utah | 8 | 6 |
| West Virginia | 12 | 25 |
| Wyoming | 43 | 44 |
| Others, HI. – 1, NV. – 1 VA. – 2 | 4 | 8 |
| **Total U.S.** | **1,002** | **909** |
| **Cum. Avg. to Date** | **964** | **800** |
| Canada | 118 | 98 |
| Canada-Offshore | 0 | 2 |
| **Grand Total** | **1,120** | **1,009** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 510** **Gas Rigs — 475**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 9-24-90 | 9-25-89 |
|---|---|---|
| Alabama | 35 | 18 |
| Alaska | 12 | 10 |
| Arkansas | 15 | 11 |
| California | 60 | 51 |
| Land | 56 | 46 |
| Offshore | 4 | 5 |
| Colorado | 35 | 30 |
| Florida | 2 | 3 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 43 | 39 |
| Kentucky | 6 | 7 |
| Louisiana | 141 | 134 |
| N. Land | 16 | 14 |
| S. Inland Waters | 18 | 15 |
| S. Land | 34 | 33 |
| Offshore | 73 | 72 |
| Maryland | 0 | 0 |
| Michigan | 9 | 19 |
| Mississippi | 13 | 14 |
| Montana | 5 | 6 |
| Nebraska | 2 | 0 |
| New Mexico | 65 | 33 |
| New York | 2 | 1 |
| North Dakota | 18 | 14 |
| Ohio | 15 | 14 |
| Oklahoma | 124 | 139 |
| Pennsylvania | 20 | 21 |

| | 9-24-90 | 9-25-89 |
|---|---|---|
| South Dakota | 0 | 2 |
| Texas | 354 | 306 |
| Offshore | 17 | 25 |
| Inland Waters | 2 | 4 |
| Dist. 1 | 70 | 8 |
| Dist. 2 | 12 | 11 |
| Dist. 3 | 33 | 26 |
| Dist. 4 | 50 | 48 |
| Dist. 5 | 17 | 10 |
| Dist. 6 | 30 | 63 |
| Dist. 7B | 12 | 7 |
| Dist. 7C | 20 | 11 |
| Dist. 8 | 44 | 46 |
| Dist. 8A | 20 | 25 |
| Dist. 9 | 16 | 11 |
| Dist. 10 | 11 | 11 |
| Utah | 8 | 10 |
| West Virginia | 14 | 20 |
| Wyoming | 47 | 52 |
| Others, HI. – 1, NV. – 1 VA. – 4 | 5 | 8 |
| **Total U.S.** | **1,055** | **967** |
| **Cum. Avg. to Date** | **972** | **815** |
| Canada | 112 | 127 |
| Canada-Offshore | 0 | 0 |
| **Grand Total** | **1,167** | **1,094** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 572** **Gas Rigs — 467**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 10-29-90 | 10-30-89 |
|---|---|---|
| Alabama | 31 | 16 |
| Alaska | 11 | 9 |
| Arkansas | 16 | 14 |
| California | 52 | 46 |
| Land | 49 | 40 |
| Offshore | 3 | 6 |
| Colorado | 43 | 41 |
| Florida | 2 | 0 |
| Illinois | 4 | 5 |
| Indiana | 0 | 0 |
| Kansas | 45 | 46 |
| Kentucky | 5 | 4 |
| Louisiana | 156 | 148 |
| N. Land | 23 | 21 |
| S. Inland Waters | 26 | 20 |
| S. Land | 35 | 37 |
| Offshore | 72 | 70 |
| Maryland | 0 | 0 |
| Michigan | 9 | 23 |
| Mississippi | 9 | 13 |
| Montana | 10 | 7 |
| Nebraska | 3 | 0 |
| New Mexico | 72 | 54 |
| New York | 0 | 0 |
| North Dakota | 13 | 21 |
| Ohio | 12 | 14 |
| Oklahoma | 141 | 132 |
| Pennsylvania | 23 | 19 |

| | 10-29-90 | 10-30-89 |
|---|---|---|
| South Dakota | 0 | 1 |
| Texas | 375 | 320 |
| Offshore | 21 | 23 |
| Inland Waters | 2 | 0 |
| Dist. 1 | 75 | 11 |
| Dist. 2 | 10 | 13 |
| Dist. 3 | 35 | 27 |
| Dist. 4 | 35 | 46 |
| Dist. 5 | 10 | 12 |
| Dist. 6 | 35 | 56 |
| Dist. 7B | 9 | 8 |
| Dist. 7C | 29 | 25 |
| Dist. 8 | 54 | 53 |
| Dist. 8A | 32 | 17 |
| Dist. 9 | 20 | 15 |
| Dist. 10 | 8 | 12 |
| Utah | 5 | 7 |
| West Virginia | 18 | 19 |
| Wyoming | 44 | 45 |
| Others, AZ. – 1, HI. – 2 NV. – 3, VA. – 2 | 8 | 6 |
| **Total U.S.** | **1,107** | **1,010** |
| **Cum. Avg. to Date** | **983** | **836** |
| Canada | 143 | 158 |
| Canada-Offshore | 0 | 0 |
| **Grand Total** | **1,250** | **1,168** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 607** **Gas Rigs — 488**
Rotary rigs from spudding in to total depth

## Baker Hughes rig count

| | 11-26-90 | 11-27-89 |
|---|---|---|
| Alabama | 30 | 16 |
| Alaska | 12 | 12 |
| Arkansas | 16 | 20 |
| California | 58 | 49 |
| Land | 55 | 44 |
| Offshore | 3 | 5 |
| Colorado | 45 | 41 |
| Florida | 1 | 1 |
| Illinois | 4 | 6 |
| Indiana | 0 | 0 |
| Kansas | 53 | 50 |
| Kentucky | 9 | 5 |
| Louisiana | 167 | 163 |
| N. Land | 20 | 20 |
| S. Inland Waters | 29 | 17 |
| S. Land | 39 | 39 |
| Offshore | 79 | 87 |
| Maryland | 0 | 0 |
| Michigan | 8 | 21 |
| Mississippi | 8 | 12 |
| Montana | 9 | 4 |
| Nebraska | 2 | 2 |
| New Mexico | 68 | 51 |
| New York | 1 | 0 |
| North Dakota | 22 | 21 |
| Ohio | 9 | 21 |
| Oklahoma | 140 | 131 |
| Pennsylvania | 14 | 15 |

| | 11-26-90 | 11-27-89 |
|---|---|---|
| South Dakota | 0 | 1 |
| Texas | 426 | 320 |
| Offshore | 21 | 23 |
| Inland Waters | 1 | 0 |
| Dist. 1 | 90 | 14 |
| Dist. 2 | 13 | 9 |
| Dist. 3 | 43 | 28 |
| Dist. 4 | 42 | 42 |
| Dist. 5 | 9 | 15 |
| Dist. 6 | 38 | 55 |
| Dist. 7B | 10 | 16 |
| Dist. 7C | 28 | 21 |
| Dist. 8 | 60 | 57 |
| Dist. 8A | 42 | 21 |
| Dist. 9 | 16 | 12 |
| Dist. 10 | 13 | 7 |
| Utah | 6 | 10 |
| West Virginia | 21 | 16 |
| Wyoming | 41 | 44 |
| Others, HI. – 2, NV. – 1 VA. – 2 | 5 | 5 |
| **Total U.S.** | **1,175** | **1,037** |
| **Cum. Avg. to Date** | **996** | **852** |
| Canada | 186 | 123 |
| Canada-Offshore | 0 | 1 |
| **Grand Total** | **1,361** | **1,161** |

Source: Baker Hughes Inc.

**Oil Rigs — 620** **Gas Rigs — 513**

## Baker Hughes rig count

| | 12-31-90 | 1-1-90 |
|---|---|---|
| Alabama | 22 | 15 |
| Alaska | 13 | 10 |
| Arkansas | 12 | 11 |
| California | 47 | 46 |
| Land | 43 | 39 |
| Offshore | 4 | 7 |
| Colorado | 29 | 31 |
| Florida | 1 | 2 |
| Illinois | 4 | 4 |
| Indiana | 0 | 0 |
| Kansas | 60 | 44 |
| Kentucky | 8 | 7 |
| Louisiana | 148 | 174 |
| N. Land | 15 | 26 |
| S. Inland Waters | 28 | 18 |
| S. Land | 33 | 50 |
| Offshore | 72 | 80 |
| Maryland | 0 | 0 |
| Michigan | 14 | 24 |
| Mississippi | 12 | 14 |
| Montana | 9 | 7 |
| Nebraska | 3 | 2 |
| New Mexico | 74 | 48 |
| New York | 4 | 0 |
| North Dakota | 19 | 22 |
| Ohio | 10 | 16 |
| Oklahoma | 128 | 134 |
| Pennsylvania | 11 | 13 |

| | 12-31-90 | 1-1-90 |
|---|---|---|
| South Dakota | 2 | 1 |
| Texas | 391 | 334 |
| Offshore | 18 | 24 |
| Inland Waters | 1 | 0 |
| Dist. 1 | 73 | 20 |
| Dist. 2 | 24 | 15 |
| Dist. 3 | 51 | 30 |
| Dist. 4 | 37 | 47 |
| Dist. 5 | 10 | 13 |
| Dist. 6 | 23 | 43 |
| Dist. 7B | 9 | 14 |
| Dist. 7C | 22 | 23 |
| Dist. 8 | 53 | 48 |
| Dist. 8A | 43 | 24 |
| Dist. 9 | 14 | 21 |
| Dist. 10 | 13 | 12 |
| Utah | 8 | 7 |
| West Virginia | 18 | 22 |
| Wyoming | 36 | 48 |
| Others, HI. – 1, NV. – 1 VA. – 1 | 3 | 6 |
| **Total U.S.** | **1,086** | **1,042** |
| **Cum. Avg. to Date** | **1,086** | **1,042** |
| Canada | 147 | 102 |
| Canada-Offshore | 0 | 0 |
| **Grand Total** | **1,233** | **1,144** |

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

**Oil Rigs — 639** **Gas Rigs — 424**
Rotary rigs from spudding in to total depth

## Smith rig count

| Proposed depth | 1-26-90 | | 1-27-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 38 | 47.4 | 25 | 48.0 |
| 2,501- 5,000 | 129 | 84.5 | 113 | 90.3 |
| 5,001- 7,500 | 166 | 71.1 | 143 | 77.6 |
| 7,501-10,000 | 256 | 54.7 | 191 | 51.8 |
| 10,001-12,500 | 190 | 32.6 | 142 | 38.7 |
| 12,501-15,000 | 115 | 32.2 | 102 | 25.5 |
| 15,001-17,500 | 66 | 30.3 | 49 | 34.7 |
| 17,501-20,000 | 23 | 21.7 | 26 | 26.9 |
| 20,001-over | 6 | — | 8 | 12.5 |
| **Total** | **989** | **51.5** | **799** | **53.8** |
| INLAND | 24 | | 15 | |
| LAND | 835 | | 675 | |
| OFFSHORE | 130 | | 109 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 4-27-90 | | 4-28-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 46 | 34.8 | 29 | 37.9 |
| 2,501- 5,000 | 176 | 75.6 | 128 | 89.8 |
| 5,001- 7,500 | 161 | 69.6 | 160 | 76.9 |
| 7,501-10,000 | 306 | 42.2 | 209 | 59.8 |
| 10,001-12,500 | 157 | 37.6 | 151 | 43.0 |
| 12,501-15,000 | 120 | 33.3 | 116 | 36.2 |
| 15,001-17,500 | 67 | 22.4 | 40 | 35.0 |
| 17,501-20,000 | 35 | 31.4 | 28 | 32.1 |
| 20,001-over | 9 | — | 6 | — |
| **Total** | **1,077** | **47.8** | **867** | **58.1** |
| INLAND | 24 | | 17 | |
| LAND | 919 | | 747 | |
| OFFSHORE | 134 | | 103 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 7-27-90 | | 7-28-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 50 | 50.0 | 36 | 41.7 |
| 2,501- 5,000 | 204 | 72.1 | 153 | 92.8 |
| 5,001- 7,500 | 159 | 76.1 | 191 | 80.6 |
| 7,501-10,000 | 292 | 44.5 | 244 | 59.0 |
| 10,001-12,500 | 169 | 47.3 | 158 | 45.6 |
| 12,501-15,000 | 134 | 26.1 | 118 | 27.1 |
| 15,001-17,500 | 73 | 12.3 | 46 | 34.8 |
| 17,501-20,000 | 32 | 21.9 | 24 | 25.0 |
| 20,001-over | 9 | — | 8 | — |
| **Total** | **1,122** | **49.4** | **978** | **59.4** |
| INLAND | 23 | | 25 | |
| LAND | 990 | | 831 | |
| OFFSHORE | 109 | | 122 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 10-26-90 | | 10-27-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 51 | 33.3 | 40 | 52.5 |
| 2,501- 5,000 | 246 | 75.6 | 200 | 83.5 |
| 5,001- 7,500 | 227 | 76.7 | 220 | 75.0 |
| 7,501-10,000 | 342 | 42.4 | 278 | 63.3 |
| 10,001-12,500 | 220 | 44.5 | 203 | 39.9 |
| 12,501-15,000 | 154 | 24.0 | 132 | 31.8 |
| 15,001-17,500 | 66 | 18.2 | 55 | 20.0 |
| 17,501-20,000 | 24 | 16.7 | 28 | 28.6 |
| 20,001-over | 12 | — | 8 | — |
| **Total** | **1,342** | **50.1** | **1,164** | **57.6** |
| INLAND | 29 | | 21 | |
| LAND | 1,188 | | 1,013 | |
| OFFSHORE | 125 | | 130 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 2-23-90 | | 2-24-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 33 | 42.4 | 20 | 30.0 |
| 2,501- 5,000 | 160 | 75.6 | 123 | 82.1 |
| 5,001- 7,500 | 166 | 77.1 | 147 | 78.9 |
| 7,501-10,000 | 245 | 47.3 | 170 | 57.6 |
| 10,001-12,500 | 172 | 38.4 | 154 | 38.3 |
| 12,501-15,000 | 114 | 27.2 | 116 | 24.1 |
| 15,001-17,500 | 69 | 18.8 | 47 | 29.8 |
| 17,501-20,000 | 20 | 25.0 | 23 | 34.8 |
| 20,001-over | 8 | — | 9 | — |
| **Total** | **987** | **50.0** | **809** | **53.2** |
| INLAND | 24 | | 20 | |
| LAND | 835 | | 680 | |
| OFFSHORE | 128 | | 109 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 5-25-90 | | 5-26-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 39 | 38.5 | 31 | 45.2 |
| 2,501- 5,000 | 188 | 65.4 | 142 | 81.7 |
| 5,001- 7,500 | 181 | 77.3 | 150 | 74.7 |
| 7,501-10,000 | 303 | 43.2 | 185 | 51.9 |
| 10,001-12,500 | 168 | 38.1 | 154 | 43.5 |
| 12,501-15,000 | 117 | 27.4 | 109 | 33.0 |
| 15,001-17,500 | 75 | 17.3 | 38 | 28.9 |
| 17,501-20,000 | 36 | 30.6 | 21 | 28.6 |
| 20,001-over | 9 | — | 6 | — |
| **Total** | **1,116** | **47.4** | **836** | **54.8** |
| INLAND | 25 | | 21 | |
| LAND | 955 | | 712 | |
| OFFSHORE | 136 | | 103 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 8-31-90 | | 9-1-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 44 | 45.5 | 37 | 43.2 |
| 2,501- 5,000 | 228 | 75.0 | 161 | 84.5 |
| 5,001- 7,500 | 207 | 74.4 | 203 | 78.3 |
| 7,501-10,000 | 303 | 43.2 | 252 | 64.7 |
| 10,001-12,500 | 196 | 41.3 | 182 | 50.0 |
| 12,501-15,000 | 128 | 25.8 | 129 | 31.0 |
| 15,001-17,500 | 71 | 22.5 | 52 | 23.1 |
| 17,501-20,000 | 28 | 17.9 | 24 | 16.7 |
| 20,001-over | 11 | 9.1 | 6 | — |
| **Total** | **1,216** | **50.3** | **1,046** | **59.4** |
| INLAND | 23 | | 24 | |
| LAND | 1,065 | | 909 | |
| OFFSHORE | 128 | | 113 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 11-30-90 | | 12-1-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 50 | 50.0 | 32 | 40.6 |
| 2,501- 5,000 | 246 | 79.3 | 200 | 84.5 |
| 5,001- 7,500 | 225 | 72.0 | 202 | 72.8 |
| 7,501-10,000 | 346 | 44.5 | 332 | 59.0 |
| 10,001-12,500 | 211 | 40.8 | 206 | 43.7 |
| 12,501-15,000 | 157 | 21.0 | 165 | 35.2 |
| 15,001-17,500 | 75 | 20.0 | 57 | 15.8 |
| 17,501-20,000 | 24 | 20.8 | 25 | 28.0 |
| 20,001-over | 13 | 7.7 | 7 | — |
| **Total** | **1,347** | **50.2** | **1,226** | **56.2** |
| INLAND | 33 | | 24 | |
| LAND | 1,187 | | 1,062 | |
| OFFSHORE | 127 | | 140 | |

* Rigs employed under footage contracts.
Definitions, see OGJ, Mar. 19, 1984, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 3-23-90 | | 3-24-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 36 | 41.7 | 24 | 25.0 |
| 2,501- 5,000 | 172 | 77.9 | 106 | 84.0 |
| 5,001- 7,500 | 142 | 81.0 | 155 | 76.8 |
| 7,501-10,000 | 283 | 45.9 | 198 | 61.1 |
| 10,001-12,500 | 170 | 37.1 | 146 | 36.3 |
| 12,501-15,000 | 137 | 38.7 | 126 | 29.4 |
| 15,001-17,500 | 67 | 10.4 | 49 | 30.6 |
| 17,501-20,000 | 28 | 28.6 | 26 | 26.9 |
| 20,001-over | 7 | — | 6 | — |
| **Total** | **1,042** | **50.4** | **836** | **53.6** |
| INLAND | 22 | | 19 | |
| LAND | 891 | | 706 | |
| OFFSHORE | 129 | | 111 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 6-22-90 | | 6-23-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 44 | 54.5 | 35 | 42.9 |
| 2,501- 5,000 | 209 | 72.7 | 132 | 87.1 |
| 5,001- 7,500 | 190 | 73.2 | 175 | 74.3 |
| 7,501-10,000 | 320 | 43.8 | 212 | 58.0 |
| 10,001-12,500 | 170 | 44.7 | 136 | 37.5 |
| 12,501-15,000 | 113 | 31.0 | 113 | 28.3 |
| 15,001-17,500 | 70 | 20.0 | 43 | 30.2 |
| 17,501-20,000 | 36 | 25.0 | 24 | 29.2 |
| 20,001-over | 9 | — | 7 | — |
| **Total** | **1,161** | **50.7** | **877** | **55.4** |
| INLAND | 22 | | 22 | |
| LAND | 1,020 | | 743 | |
| OFFSHORE | 119 | | 112 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 9-28-90 | | 9-29-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2.500 | 33 | 24.2 | 36 | 47.2 |
| 2.501- 5.000 | 235 | 76.6 | 175 | 88.0 |
| 5.001- 7.500 | 218 | 73.4 | 204 | 72.5 |
| 7.501-10.000 | 342 | 40.4 | 270 | 65.2 |
| 10.001-12.500 | 201 | 36.8 | 173 | 46.8 |
| 12.501-15.000 | 137 | 24.1 | 147 | 33.3 |
| 15.001-17.500 | 58 | 19.0 | 46 | 21.7 |
| 17.501-20.000 | 24 | 16.7 | 28 | 17.9 |
| 20.001-over | 11 | — | 6 | — |
| **Total** | **1,259** | **48.3** | **1,085** | **59.0** |
| INLAND | 25 | | 22 | |
| LAND | 1.116 | | 952 | |
| OFFSHORE | 118 | | 111 | |

* Rigs employed under footage contracts.
Definitions. see OGJ 3/19/84. p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## Smith rig count

| Proposed depth | 12-28-90 | | 12-29-89 | |
|---|---|---|---|---|
| (feet) | Rig count | % footage* | Rig count | % footage* |
| 0- 2,500 | 35 | 31.4 | 28 | 39.3 |
| 2,501- 5,000 | 161 | 82.6 | 144 | 84.0 |
| 5,001- 7,500 | 166 | 68.7 | 205 | 73.7 |
| 7,501-10,000 | 334 | 41.3 | 291 | 58.1 |
| 10,001-12,500 | 199 | 35.2 | 210 | 39.0 |
| 12,501-15,000 | 144 | 21.5 | 143 | 35.7 |
| 15,001-17,500 | 67 | 17.9 | 64 | 26.6 |
| 17,501-20,000 | 26 | 15.4 | 23 | 17.4 |
| 20,001-over | 14 | 7.1 | 7 | — |
| **Total** | **1,146** | **44.9** | **1,115** | **54.3** |
| INLAND | 29 | | 21 | |
| LAND | 1,010 | | 956 | |
| OFFSHORE | 107 | | 138 | |

* Rigs employed under footage contracts.
Definitions, see OGJ 3/19/84, p. 138.
Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 1-26-90* | 1-27-89† |
|---|---|---|
| Alabama | 49 | 56 |
| Alaska | 1,905 | 1,958 |
| California | 998 | 999 |
| Colorado | 82 | 88 |
| Florida | 20 | 21 |
| Illinois | 57 | 60 |
| Kansas | 143 | 149 |
| Louisiana | 1,088 | 1,168 |
| Michigan | 58 | 62 |
| Mississippi | 75 | 75 |

| | 1-26-90* | 1-27-89† |
|---|---|---|
| Montana | 56 | 58 |
| New Mexico | 185 | 198 |
| North Dakota | 99 | 102 |
| Oklahoma | 309 | 331 |
| Texas | 1,897 | 2,005 |
| Utah | 74 | 81 |
| Wyoming | 295 | 305 |
| All others | 130 | 134 |
| Total | 7,520 | 7,850 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 3-23-90* | 3-24-89† |
|---|---|---|
| Alabama | 50 | 56 |
| Alaska | 1,879 | 1,741 |
| California | 987 | 1,000 |
| Colorado | 80 | 88 |
| Florida | 18 | 20 |
| Illinois | 56 | 63 |
| Kansas | 142 | 153 |
| Louisiana | 1,060 | 1,153 |
| Michigan | 56 | 59 |
| Mississippi | 75 | 74 |

| | 3-23-90* | 3-24-89† |
|---|---|---|
| Montana | 54 | 58 |
| New Mexico | 184 | 191 |
| North Dakota | 99 | 102 |
| Oklahoma | 310 | 324 |
| Texas | 1,873 | 1,971 |
| Utah | 75 | 80 |
| Wyoming | 290 | 302 |
| All others | 123 | 132 |
| Total | 7,411 | 7,567 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 5-25-90* | 5-26-89† |
|---|---|---|
| Alabama | 51 | 56 |
| Alaska | 1,824 | 1,973 |
| California | 980 | 1,000 |
| Colorado | 79 | 85 |
| Florida | 17 | 21 |
| Illinois | 53 | 59 |
| Kansas | 143 | 141 |
| Louisiana | 1,045 | 1,174 |
| Michigan | 54 | 58 |
| Mississippi | 73 | 75 |

| | 5-25-90* | 5-26-89† |
|---|---|---|
| Montana | 54 | 59 |
| New Mexico | 186 | 187 |
| North Dakota | 101 | 99 |
| Oklahoma | 315 | 327 |
| Texas | 1,882 | 1,951 |
| Utah | 75 | 80 |
| Wyoming | 289 | 299 |
| All others | 119 | 137 |
| Total | 7,340 | 7,781 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 7-27-90* | 7-28-89† |
|---|---|---|
| Alabama | 51 | 57 |
| Alaska | 1,620 | 1,725 |
| California | 968 | 1,002 |
| Colorado | 78 | 82 |
| Florida | 18 | 19 |
| Illinois | 54 | 56 |
| Kansas | 148 | 150 |
| Louisiana | 1,036 | 1,112 |
| Michigan | 54 | 58 |
| Mississippi | 73 | 76 |

| | 7-27-90* | 7-28-89† |
|---|---|---|
| Montana | 54 | 57 |
| New Mexico | 182 | 186 |
| North Dakota | 101 | 101 |
| Oklahoma | 300 | 318 |
| Texas | 1,910 | 1,945 |
| Utah | 75 | 79 |
| Wyoming | 285 | 294 |
| All others | 117 | 127 |
| Total | 7,124 | 7,444 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 9-28-90* | 9-29-89† |
|---|---|---|
| Alabama | 52 | 55 |
| Alaska | 1,740 | 1,875 |
| California | 965 | 991 |
| Colorado | 81 | 81 |
| Florida | 16 | 21 |
| Illinois | 54 | 57 |
| Kansas | 149 | 149 |
| Louisiana | 1,034 | 1,095 |
| Michigan | 54 | 58 |
| Mississippi | 73 | 75 |

| | 9-28-90* | 9-29-89† |
|---|---|---|
| Montana | 54 | 57 |
| New Mexico | 178 | 184 |
| North Dakota | 98 | 99 |
| Oklahoma | 286 | 318 |
| Texas | 1,870 | 1,930 |
| Utah | 76 | 79 |
| Wyoming | 284 | 296 |
| All others | 112 | 128 |
| Total | 7,176 | 7,548 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 11-30-90* | 12-1-89† |
|---|---|---|
| Alabama | 49 | 49 |
| Alaska | 1,890 | 1,913 |
| California | 958 | 983 |
| Colorado | 80 | 82 |
| Florida | 13 | 20 |
| Illinois | 54 | 55 |
| Kansas | 147 | 148 |
| Louisiana | 1,025 | 1,054 |
| Michigan | 54 | 56 |
| Mississippi | 73 | 74 |

| | 11-30-90* | 12-1-89† |
|---|---|---|
| Montana | 53 | 56 |
| New Mexico | 180 | 187 |
| North Dakota | 100 | 102 |
| Oklahoma | 285 | 310 |
| Texas | 1,868 | 1,919 |
| Utah | 75 | 75 |
| Wyoming | 285 | 291 |
| All others | 114 | 123 |
| Total | 7,303 | 7,497 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 2-23-90* | 2-24-89† |
|---|---|---|
| Alabama | 47 | 56 |
| Alaska | 1,890 | 1,962 |
| California | 993 | 1,003 |
| Colorado | 82 | 85 |
| Florida | 18 | 20 |
| Illinois | 55 | 65 |
| Kansas | 142 | 146 |
| Louisiana | 1,069 | 1,201 |
| Michigan | 56 | 60 |
| Mississippi | 75 | 74 |

| | 2-23-90* | 2-24-89† |
|---|---|---|
| Montana | 56 | 57 |
| New Mexico | 184 | 189 |
| North Dakota | 99 | 101 |
| Oklahoma | 309 | 303 |
| Texas | 1,879 | 1,957 |
| Utah | 74 | 79 |
| Wyoming | 292 | 296 |
| All others | 124 | 132 |
| Total | 7,444 | 7,786 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 4-27-90* | 4-28-89† |
|---|---|---|
| Alabama | 52 | 57 |
| Alaska | 1,840 | 1,890 |
| California | 980 | 999 |
| Colorado | 78 | 89 |
| Florida | 20 | 20 |
| Illinois | 58 | 61 |
| Kansas | 148 | 155 |
| Louisiana | 1,052 | 1,192 |
| Michigan | 56 | 58 |
| Mississippi | 71 | 76 |

| | 4-27-90* | 4-28-89† |
|---|---|---|
| Montana | 54 | 57 |
| New Mexico | 186 | 186 |
| North Dakota | 101 | 100 |
| Oklahoma | 314 | 329 |
| Texas | 1,865 | 1,968 |
| Utah | 73 | 76 |
| Wyoming | 291 | 301 |
| All others | 122 | 139 |
| Total | 7,361 | 7,753 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 6-29-90* | 6-30-89† |
|---|---|---|
| Alabama | 52 | 56 |
| Alaska | 1,570 | 1,861 |
| California | 970 | 999 |
| Colorado | 78 | 85 |
| Florida | 18 | 20 |
| Illinois | 53 | 59 |
| Kansas | 147 | 153 |
| Louisiana | 1,035 | 1,104 |
| Michigan | 54 | 59 |
| Mississippi | 72 | 78 |

| | 6-29-90* | 6-30-89† |
|---|---|---|
| Montana | 53 | 59 |
| New Mexico | 182 | 185 |
| North Dakota | 101 | 98 |
| Oklahoma | 312 | 320 |
| Texas | 1,910 | 1,925 |
| Utah | 74 | 68 |
| Wyoming | 284 | 296 |
| All others | 117 | 136 |
| Total | 7,082 | 7,561 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 8-31-90* | 9-1-89† |
|---|---|---|
| Alabama | 51 | 56 |
| Alaska | 1,710 | 1,871 |
| California | 966 | 997 |
| Colorado | 80 | 82 |
| Florida | 16 | 20 |
| Illinois | 54 | 57 |
| Kansas | 146 | 153 |
| Louisiana | 1,030 | 1,080 |
| Michigan | 55 | 59 |
| Mississippi | 73 | 77 |

| | 8-31-90* | 9-1-89† |
|---|---|---|
| Montana | 54 | 57 |
| New Mexico | 180 | 185 |
| North Dakota | 99 | 100 |
| Oklahoma | 288 | 317 |
| Texas | 1,880 | 1,941 |
| Utah | 75 | 78 |
| Wyoming | 284 | 284 |
| All others | 115 | 131 |
| Total | 7,156 | 7,545 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 10-26-90* | 10-27-89† |
|---|---|---|
| Alabama | 49 | 48 |
| Alaska | 1,920 | 1,877 |
| California | 960 | 985 |
| Colorado | 80 | 83 |
| Florida | 14 | 21 |
| Illinois | 56 | 57 |
| Kansas | 148 | 150 |
| Louisiana | 1,030 | 1,016 |
| Michigan | 54 | 59 |
| Mississippi | 73 | 76 |

| | 10-26-90* | 10-27-89† |
|---|---|---|
| Montana | 53 | 56 |
| New Mexico | 178 | 187 |
| North Dakota | 99 | 102 |
| Oklahoma | 282 | 319 |
| Texas | 1,870 | 1,919 |
| Utah | 76 | 78 |
| Wyoming | 284 | 291 |
| All others | 112 | 129 |
| Total | 7,338 | 7,453 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database

## OGJ production report

Crude oil and lease condensate
(1,000 b/d)

| | 12-28-90* | 12-29-89† |
|---|---|---|
| Alabama | 49 | 50 |
| Alaska | 1,970 | 1,904 |
| California | 954 | 985 |
| Colorado | 79 | 79 |
| Florida | 13 | 18 |
| Illinois | 47 | 47 |
| Kansas | 140 | 138 |
| Louisiana | 1,012 | 1,014 |
| Michigan | 53 | 54 |
| Mississippi | 71 | 71 |

| | 12-28-90* | 12-29-89† |
|---|---|---|
| Montana | 53 | 54 |
| New Mexico | 180 | 181 |
| North Dakota | 100 | 100 |
| Oklahoma | 288 | 289 |
| Texas | 1,870 | 1,871 |
| Utah | 76 | 78 |
| Wyoming | 285 | 289 |
| All others | 115 | 115 |
| Total | 7,355 | 7,337 |

*OGJ estimate †Revised

Source: Oil & Gas Journal
Data available in Oil & Gas Journal Energy Database.

## API refinery report—January 26, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Motor gasoline | | | Jet fuel | | Fuel oils | |
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,537 | 1,333 | 1,365 | 1,325 | 103.0 | 681 | — | 681 | 26 | 98 | 359 | 210 |
| App. Dist. 1 | 111 | 104 | 104 | 124 | 83.9 | 37 | 5 | 32 | 6 | — | 32 | 1 |
| **Dist. 1 total** | **1,648** | **1,437** | **1,469** | **1,449** | **101.4** | **718** | **5** | **713** | **32** | **98** | **391** | **211** |
| Ind., Ill., Ky. | 2,102 | 1,970 | 1,985 | 2,198 | 90.3 | 1,233 | 8 | 1,225 | — | 144 | 499 | 63 |
| Minn., Wis., Dak. | 318 | 314 | 315 | 337 | 93.5 | 150 | 17 | 133 | 1 | 30 | 79 | 9 |
| Okla., Kan., Mo. | 744 | 673 | 684 | 730 | 93.7 | 389 | 72 | 317 | 8 | 52 | 169 | 11 |
| **Dist. 2 total** | **3,164** | **2,957** | **2,984** | **3,265** | **91.4** | **1,772** | **97** | **1,675** | **9** | **226** | **747** | **83** |
| Inland Texas | 545 | 492 | 501 | 568 | 88.2 | 284 | 27 | 257 | 30 | 35 | 120 | 18 |
| Texas Gulf coast | 3,524 | 3,044 | 3,054 | 3,477 | 87.8 | 1,714 | 39 | 1,675 | 47 | 313 | 645 | 293 |
| La. Gulf Coast | 2,591 | 2,316 | 2,334 | 2,938 | 79.4 | 1,077 | 22 | 1,055 | 11 | 301 | 564 | 148 |
| N. La. and Ark. | 184 | 176 | 179 | 247 | 72.5 | 61 | — | 61 | 6 | 2 | 56 | 11 |
| New Mexico | 77 | 73 | 73 | 76 | 96.1 | 42 | 11 | 31 | 12 | 3 | 16 | 1 |
| **Dist. 3 total** | **6,921** | **6,101** | **6,141** | **7,306** | **84.1** | **3,178** | **99** | **3,079** | **106** | **654** | **1,401** | **471** |
| **Dist. 4 total** | **465** | **447** | **448** | **546** | **82.1** | **225** | **42** | **183** | **11** | **32** | **114** | **17** |
| **Dist. 5 total** | **2,907** | **2,760** | **2,808** | **3,038** | **92.4** | **1,155** | **207** | **948** | **31** | **365** | **398** | **416** |
| **January 26, 1990** | **15,105** | **13,702** | **13,850** | **15,604** | **88.8** | **7,048** | **450** | **6,598** | **189** | **1,375** | **3,051** | **1,198** |
| **January 19, 1990†** | **14,884** | **13,604** | **13,771** | **15,604** | **88.3** | **6,801** | **500** | **6,301** | **191** | **1,304** | **3,210** | **1,180** |
| **January 27, 1989** | **14,897** | **13,371** | **13,502** | **15,907** | **84.9** | **6,918** | **964** | **5,954** | **199** | **1,369** | **2,905** | **925** |

*Included in total motor gasoline. †Revised.

Source: American Petroleum Institute

Data available in Oil & Gas Journal Energy Database.

## API refinery report—February 23, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Motor gasoline | | | Jet fuel | | Fuel oils | |
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,420 | 1,273 | 1,282 | 1,325 | 96.8 | 620 | 26 | 594 | 8 | 88 | 309 | 190 |
| App. Dist. 1 | 106 | 96 | 96 | 124 | 77.4 | 31 | 3 | 28 | 5 | — | 27 | 2 |
| **Dist. 1 total** | **1,526** | **1,369** | **1,378** | **1,449** | **95.1** | **651** | **29** | **622** | **13** | **88** | **336** | **192** |
| Ind., Ill., Ky. | 2,211 | 1,967 | 1,971 | 2,198 | 89.7 | 1,204 | 14 | 1,190 | 7 | 137 | 374 | 53 |
| Minn., Wis., Dak. | 313 | 297 | 299 | 337 | 88.7 | 151 | 1 | 150 | — | 18 | 110 | 6 |
| Okla., Kan., Mo. | 725 | 673 | 678 | 730 | 92.9 | 390 | 32 | 358 | 7 | 50 | 174 | 11 |
| **Dist. 2 total** | **3,249** | **2,937** | **2,948** | **3,265** | **90.3** | **1,745** | **47** | **1,698** | **14** | **205** | **658** | **70** |
| Inland Texas | 550 | 503 | 506 | 568 | 89.1 | 309 | 32 | 277 | 27 | 37 | 120 | 15 |
| Texas Gulf coast | 3,272 | 2,922 | 2,952 | 3,477 | 84.9 | 1,483 | 11 | 1,472 | 54 | 314 | 449 | 257 |
| La. Gulf Coast | 2,554 | 2,403 | 2,430 | 2,938 | 82.7 | 1,092 | 30 | 1,062 | 14 | 297 | 495 | 124 |
| N. La. and Ark. | 194 | 180 | 181 | 247 | 73.3 | 61 | 2 | 59 | 9 | — | 56 | 12 |
| New Mexico | 81 | 71 | 71 | 76 | 93.4 | 40 | 12 | 28 | 11 | 1 | 15 | — |
| **Dist. 3 total** | **6,651** | **6,079** | **6,140** | **7,306** | **84.0** | **2,985** | **87** | **2,898** | **115** | **649** | **1,135** | **408** |
| **Dist. 4 total** | **481** | **457** | **462** | **546** | **84.6** | **219** | **46** | **173** | **11** | **28** | **121** | **12** |
| **Dist. 5 total** | **2,701** | **2,617** | **2,701** | **3,048** | **88.6** | **1,246** | **138** | **1,108** | **52** | **319** | **448** | **321** |
| **February 23, 1990** | **14,608** | **13,459** | **13,629** | **15,614** | **87.3** | **6,846** | **347** | **6,499** | **205** | **1,289** | **2,698** | **1,003** |
| **February 16, 1990†** | **14,908** | **13,608** | **13,803** | **15,614** | **88.4** | **6,948** | **348** | **6,600** | **170** | **1,288** | **2,730** | **1,035** |
| **February 24, 1989** | **14,195** | **12,699** | **12,823** | **15,907** | **80.6** | **6,625** | **908** | **5,717** | **212** | **1,246** | **2,898** | **943** |

*Included in total motor gasoline. †Revised.

Source: American Petroleum Institute

Data available in Oil & Gas Journal Energy Database.

## API refinery report—March 23, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Motor gasoilne | | | Jet fuel | | Fuel oils | |
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,294 | 1,153 | 1,154 | 1,325 | 87.1 | 541 | 1 | 540 | 17 | 85 | 276 | 121 |
| App. Dist. 1 | 106 | 97 | 97 | 124 | 78.2 | 32 | 2 | 30 | 6 | — | 31 | 2 |
| **Dist. 1 total** | **1,400** | **1,250** | **1,251** | **1,449** | **86.3** | **573** | **3** | **570** | **23** | **85** | **307** | **123** |
| Ind., Ill., Ky. | 2,096 | 1,902 | 1,902 | 2,198 | 86.5 | 1,127 | 9 | 1,118 | — | 161 | 396 | 46 |
| Minn., Wis., Dak. | 331 | 320 | 320 | 337 | 95.0 | 162 | 12 | 150 | — | 12 | 84 | 6 |
| Okla., Kan., Mo. | 620 | 576 | 603 | 730 | 82.6 | 343 | 30 | 313 | 15 | 28 | 153 | 4 |
| **Dist. 2 total** | **3,047** | **2,798** | **2,825** | **3,265** | **86.5** | **1,632** | **51** | **1,581** | **15** | **201** | **633** | **56** |
| Inland Texas | 577 | 509 | 512 | 568 | 90.1 | 323 | 28 | 295 | 26 | 40 | 120 | 14 |
| Texas Gulf coast | 3,212 | 2,719 | 2,746 | 3,477 | 79.0 | 1,517 | — | 1,517 | 29 | 259 | 508 | 206 |
| La. Gulf Coast | 2,303 | 2,214 | 2,255 | 2,938 | 76.8 | 956 | 42 | 914 | 9 | 273 | 473 | 128 |
| N. La. and Ark. | 189 | 183 | 183 | 247 | 74.1 | 53 | — | 53 | 8 | 4 | 48 | 7 |
| New Mexico | 76 | 69 | 70 | 76 | 92.1 | 41 | 11 | 30 | 11 | 3 | 14 | 1 |
| **Dist. 3 total** | **6,357** | **5,694** | **5,766** | **7,306** | **78.9** | **2,890** | **81** | **2,809** | **83** | **579** | **1,163** | **356** |
| **Dist. 4 total** | **479** | **415** | **418** | **546** | **76.6** | **226** | **50** | **176** | **11** | **32** | **116** | **10** |
| **Dist. 5 total** | **2,805** | **2,748** | **2,805** | **3,048** | **92.0** | **1,158** | **151** | **1,007** | **61** | **389** | **396** | **411** |
| **March 23, 1990** | **14,088** | **12,905** | **13,065** | **15,614** | **83.7** | **6,479** | **336** | **6,143** | **193** | **1,286** | **2,615** | **956** |
| **March 16, 1990†** | **13,939** | **12,941** | **13,068** | **15,614** | **83.7** | **6,421** | **387** | **6,034** | **199** | **1,246** | **2,537** | **1,015** |
| **March 24, 1989** | **14,168** | **12,748** | **12,938** | **15,907** | **81.3** | **6,442** | **855** | **5,587** | **224** | **1,178** | **2,679** | **951** |

*Included in total motor gasoline. †Revised.

Source: American Petroleum Institute

Data available in Oil & Gas Journal Energy Database.

## API refinery report—April 27, 1990

| District | Refinery operations (Thousands of barrels daily) Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Refinery output (Thousands of barrels daily) Motor gasoline Total | Motor gasoline Leaded* | Motor gasoline Unleaded* | Jet fuel Naphtha | Jet fuel Kero | Fuel oils Distillate | Fuel oils Residual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East coast | 1,201 | 1,065 | 1,065 | 1,325 | 80.4 | 595 | — | 595 | 19 | 81 | 276 | 97 |
| App. Dist. 1 | 99 | 92 | 92 | 124 | 74.2 | 44 | — | 44 | 3 | — | 29 | 2 |
| **Dist. 1 total** | **1,300** | **1,157** | **1,157** | **1,449** | **79.8** | **639** | — | **639** | **22** | **81** | **305** | **99** |
| Ind., Ill., Ky. | 2,062 | 1,957 | 1,963 | 2,198 | 89.3 | 1,063 | 8 | 1,055 | 4 | 106 | 445 | 64 |
| Minn., Wis., Dak. | 270 | 257 | 257 | 337 | 76.3 | 159 | 13 | 146 | — | 16 | 66 | 7 |
| Okla., Kan., Mo. | 727 | 702 | 719 | 730 | 98.5 | 396 | 61 | 335 | 6 | 26 | 206 | 5 |
| **Dist. 2 total** | **3,059** | **2,916** | **2,939** | **3,265** | **90.0** | **1,618** | **82** | **1,536** | **10** | **148** | **717** | **76** |
| Inland Texas | 499 | 478 | 485 | 568 | 85.4 | 308 | 22 | 286 | 31 | 27 | 95 | 18 |
| Texas Gulf coast | 3,444 | 3,067 | 3,101 | 3,477 | 89.2 | 1,670 | 19 | 1,651 | 31 | 226 | 699 | 177 |
| La. Gulf Coast | 2,174 | 2,007 | 2,040 | 2,938 | 69.4 | 1,114 | 16 | 1,098 | 14 | 258 | 362 | 110 |
| N. La. and Ark. | 197 | 186 | 192 | 247 | 77.7 | 60 | — | 60 | 7 | 9 | 51 | 10 |
| New Mexico | 67 | 66 | 67 | 76 | 88.2 | 30 | 6 | 24 | 8 | 2 | 15 | 1 |
| **Dist. 3 total** | **6,381** | **5,804** | **5,885** | **7,306** | **80.6** | **3,182** | **63** | **3,119** | **91** | **522** | **1,222** | **316** |
| **Dist. 4 total** | **432** | **421** | **424** | **546** | **77.7** | **228** | **46** | **182** | **24** | **17** | **138** | **9** |
| **Dist. 5 total** | **2,707** | **2,682** | **2,682** | **3,048** | **88.0** | **1,244** | **182** | **1,062** | **31** | **387** | **426** | **345** |
| **April 27, 1990** | **13,879** | **12,980** | **13,087** | **15,614** | **83.8** | **6,911** | **373** | **6,538** | **178** | **1,155** | **2,808** | **845** |
| **April 20, 1990†** | **14,398** | **13,281** | **13,466** | **15,614** | **86.2** | **7,061** | **460** | **6,601** | **205** | **1,076** | **2,960** | **927** |
| **April 28, 1989** | **14,254** | **13,078** | **13,230** | **15,907** | **83.2** | **6,949** | **827** | **6,122** | **191** | **1,039** | **2,794** | **929** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—May 25, 1990

| District | Refinery operations (Thousands of barrels daily) Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Refinery output (Thousands of barrels daily) Motor gasoline Total | Motor gasoline Leaded* | Motor gasoline Unleaded* | Jet fuel Naphtha | Jet fuel Kero | Fuel oils Distillate | Fuel oils Residual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East coast | 1,263 | 1,141 | 1,141 | 1,325 | 86.1 | 557 | 13 | 544 | 5 | 69 | 264 | 92 |
| App. Dist. 1 | 95 | 87 | 88 | 124 | 71.0 | 37 | 3 | 34 | 1 | — | 30 | 3 |
| **Dist. 1 total** | **1,358** | **1,228** | **1,229** | **1,449** | **84.8** | **594** | **16** | **578** | **6** | **69** | **294** | **95** |
| Ind., Ill., Ky. | 2,215 | 2,123 | 2,123 | 2,198 | 96.6 | 1,136 | 15 | 1,121 | 11 | 105 | 435 | 74 |
| Minn., Wis., Dak. | 276 | 262 | 264 | 337 | 78.3 | 140 | 19 | 121 | — | 16 | 69 | 8 |
| Okla., Kan., Mo. | 782 | 736 | 751 | 730 | 102.9 | 439 | 76 | 363 | 11 | 32 | 202 | 5 |
| **Dist. 2 total** | **3,273** | **3,121** | **3,138** | **3,265** | **96.1** | **1,715** | **110** | **1,605** | **22** | **153** | **706** | **87** |
| Inland Texas | 609 | 561 | 561 | 568 | 98.8 | 312 | 23 | 289 | 26 | 27 | 123 | 12 |
| Texas Gulf coast | 3,356 | 2,960 | 2,972 | 3,477 | 85.5 | 1,693 | 16 | 1,677 | 33 | 266 | 519 | 252 |
| La. Gulf Coast | 2,677 | 2,552 | 2,602 | 2,938 | 88.6 | 1,125 | 71 | 1,054 | 17 | 308 | 430 | 116 |
| N. La. and Ark. | 200 | 187 | 187 | 247 | 75.7 | 49 | — | 49 | 6 | 8 | 48 | 10 |
| New Mexico | 70 | 72 | 72 | 76 | 94.7 | 43 | 9 | 34 | 9 | 3 | 16 | 1 |
| **Dist. 3 total** | **6,912** | **6,332** | **6,394** | **7,306** | **87.5** | **3,222** | **119** | **3,103** | **91** | **612** | **1,136** | **391** |
| **Dist. 4 total** | **509** | **496** | **500** | **546** | **91.6** | **276** | **64** | **212** | **9** | **29** | **142** | **10** |
| **Dist. 5 total** | **2,548** | **2,470** | **2,548** | **3,048** | **83.6** | **1,084** | **171** | **913** | **41** | **320** | **526** | **340** |
| **May 25, 1990** | **14,600** | **13,647** | **13,809** | **15,614** | **88.4** | **6,891** | **480** | **6,411** | **169** | **1,183** | **2,804** | **923** |
| **May 18, 1990†** | **13,926** | **13,155** | **13,270** | **15,614** | **85.0** | **6,600** | **343** | **6,257** | **214** | **1,186** | **2,742** | **889** |
| **May 26, 1989** | **14,582** | **13,733** | **13,885** | **15,674** | **88.6** | **7,099** | **842** | **6,257** | **197** | **1,152** | **2,754** | **1,031** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—June 22, 1990

| District | Refinery operations (Thousands of barrels daily) Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Refinery output (Thousands of barrels daily) Motor gasoline Total | Motor gasoline Leaded* | Motor gasoline Unleaded* | Jet fuel Naphtha | Jet fuel Kero | Fuel oils Distillate | Fuel oils Residual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East coast | 1,332 | 1,197 | 1,199 | 1,325 | 90.5 | 549 | 5 | 544 | 2 | 71 | 359 | 103 |
| App. Dist. 1 | 104 | 97 | 98 | 124 | 79.0 | 32 | 4 | 28 | 3 | — | 31 | 2 |
| **Dist. 1 total** | **1,436** | **1,294** | **1,297** | **1,449** | **89.5** | **581** | **9** | **572** | **5** | **71** | **390** | **105** |
| Ind., Ill., Ky. | 2,180 | 2,072 | 2,077 | 2,198 | 94.5 | 1,187 | 6 | 1,181 | 12 | 115 | 429 | 56 |
| Minn., Wis., Dak. | 378 | 364 | 364 | 337 | 108.0 | 202 | 8 | 194 | 2 | 21 | 94 | 11 |
| Okla., Kan., Mo. | 779 | 755 | 758 | 730 | 103.8 | 414 | 43 | 371 | 3 | 30 | 213 | 5 |
| **Dist. 2 total** | **3,337** | **3,191** | **3,199** | **3,265** | **98.0** | **1,803** | **57** | **1,746** | **17** | **166** | **736** | **72** |
| Inland Texas | 569 | 541 | 549 | 568 | 96.7 | 312 | 25 | 287 | 22 | 34 | 116 | 13 |
| Texas Gulf coast | 3,559 | 3,054 | 3,077 | 3,477 | 88.5 | 1,650 | 1 | 1,649 | 20 | 275 | 631 | 233 |
| La. Gulf Coast | 2,406 | 2,295 | 2,330 | 2,938 | 79.3 | 1,203 | 12 | 1,191 | 7 | 274 | 509 | 121 |
| N. La. and Ark. | 190 | 187 | 187 | 247 | 75.7 | 57 | — | 57 | 9 | 4 | 57 | 9 |
| New Mexico | 103 | 77 | 77 | 76 | 101.3 | 45 | 8 | 37 | 11 | 1 | 18 | 1 |
| **Dist. 3 total** | **6,827** | **6,154** | **6,220** | **7,306** | **85.1** | **3,267** | **46** | **3,221** | **69** | **588** | **1,331** | **377** |
| **Dist. 4 total** | **519** | **508** | **513** | **546** | **94.0** | **258** | **72** | **186** | **17** | **31** | **135** | **10** |
| **Dist. 5 total** | **2,496** | **2,338** | **2,456** | **3,048** | **80.6** | **1,210** | **188** | **1,022** | **25** | **296** | **386** | **342** |
| **June 22, 1990** | **14,615** | **13,485** | **13,685** | **15,614** | **87.6** | **7,119** | **372** | **6,747** | **133** | **1,152** | **2,978** | **906** |
| **June 15, 1990** | **14,626** | **13,537** | **13,758** | **15,614** | **88.1** | **7,139** | **376** | **6,763** | **232** | **1,148** | **2,985** | **913** |
| **June 23, 1989** | **14,830** | **13,994** | **14,120** | **15,674** | **90.1** | **7,346** | **858** | **6,488** | **206** | **1,141** | **2,908** | **930** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—July 27, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Motor gasoline | | | Jet fuel | | Fuel oils | |
| | | | | | | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,489 | 1,336 | 1,336 | 1,381 | 96.7 | 641 | 14 | 627 | 2 | 70 | 363 | 144 |
| App. Dist. 1 | 105 | 99 | 99 | 124 | 79.8 | 43 | 2 | 41 | 2 | — | 29 | 2 |
| **Dist. 1 total** | **1,594** | **1,435** | **1,435** | **1,505** | **95.3** | **684** | **16** | **668** | **4** | **70** | **392** | **146** |
| Ind., Ill., Ky. | 2,271 | 2,135 | 2,145 | 2,195 | 97.7 | 1,244 | 11 | 1,233 | 5 | 107 | 474 | 38 |
| Minn., Wis., Dak. | 372 | 361 | 366 | 343 | 106.7 | 173 | 14 | 159 | — | 10 | 89 | 10 |
| Okla., Kan., Mo. | 835 | 765 | 765 | 737 | 103.8 | 434 | 47 | 387 | 11 | 29 | 216 | 4 |
| **Dist. 2 total** | **3,478** | **3,261** | **3,276** | **3,275** | **100.0** | **1,851** | **72** | **1,779** | **16** | **146** | **779** | **52** |
| Inland Texas | 597 | 529 | 530 | 584 | 90.8 | 304 | 22 | 282 | 26 | 34 | 115 | 22 |
| Texas Gulf coast | 3,623 | 3,193 | 3,214 | 3,339 | 96.3 | 1,754 | 2 | 1,752 | 30 | 320 | 590 | 227 |
| La. Gulf Coast | 2,599 | 2,499 | 2,530 | 2,903 | 87.2 | 1,169 | 17 | 1,152 | 8 | 350 | 491 | 122 |
| N. La. and Ark. | 197 | 188 | 192 | 257 | 74.7 | 54 | — | 54 | 5 | 6 | 48 | 9 |
| New Mexico | 83 | 75 | 75 | 78 | 96.2 | 45 | 12 | 33 | 8 | 2 | 16 | 1 |
| **Dist. 3 total** | **7,099** | **6,484** | **6,541** | **7,161** | **91.3** | **3,326** | **53** | **3,273** | **77** | **712** | **1,260** | **381** |
| **Dist. 4 total** | **532** | **500** | **508** | **556** | **91.4** | **285** | **70** | **215** | **6** | **26** | **151** | **6** |
| **Dist. 5 total** | **2,868** | **2,681** | **2,778** | **3,019** | **92.0** | **1,285** | **164** | **1,121** | **48** | **344** | **494** | **455** |
| **July 27, 1990** | **15,571** | **14,361** | **14,538** | **15,516** | **93.7** | **7,431** | **375** | **7,056** | **151** | **1,298** | **3,076** | **1,040** |
| **July 20, 1990†** | **15,507** | **14,304** | **14,536** | **15,516** | **93.7** | **7,414** | **465** | **6,949** | **123** | **1,293** | **2,929** | **986** |
| **July 28, 1989** | **15,233** | **13,915** | **14,177** | **15,576** | **91.0** | **7,416** | **767** | **6,649** | **227** | **1,192** | **2,926** | **845** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—August 31, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Motor gasoline | | | Jet fuel | | Fuel oils | |
| | | | | | | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,363 | 1,138 | 1,158 | 1,381 | 83.9 | 647 | 4 | 643 | 9 | 57 | 313 | 86 |
| App. Dist. 1 | 105 | 102 | 102 | 124 | 82.3 | 42 | 3 | 39 | — | — | 32 | 2 |
| **Dist. 1 total** | **1,468** | **1,240** | **1,260** | **1,505** | **83.7** | **689** | **7** | **682** | **9** | **57** | **345** | **88** |
| Ind., Ill., Ky. | 2,217 | 2,142 | 2,162 | 2,195 | 98.5 | 1,262 | 7 | 1,255 | 7 | 110 | 442 | 49 |
| Minn., Wis., Dak. | 361 | 358 | 358 | 343 | 104.4 | 177 | 13 | 164 | — | 24 | 97 | 12 |
| Okla., Kan., Mo. | 800 | 741 | 741 | 737 | 100.5 | 417 | 37 | 380 | 3 | 30 | 195 | 5 |
| **Dist. 2 total** | **3,378** | **3,241** | **3,261** | **3,275** | **99.6** | **1,856** | **57** | **1,799** | **10** | **164** | **734** | **66** |
| Inland Texas | 529 | 512 | 512 | 584 | 87.7 | 323 | 21 | 302 | 31 | 37 | 110 | 12 |
| Texas Gulf coast | 3,416 | 3,112 | 3,112 | 3,339 | 93.2 | 1,576 | 3 | 1,573 | 41 | 300 | 672 | 239 |
| La. Gulf Coast | 2,508 | 2,420 | 2,454 | 2,903 | 84.5 | 1,155 | 28 | 1,127 | 19 | 285 | 498 | 153 |
| N. La. and Ark. | 187 | 166 | 166 | 257 | 64.6 | 50 | — | 50 | 3 | 3 | 53 | 8 |
| New Mexico | 82 | 76 | 76 | 78 | 97.4 | 48 | 12 | 36 | 10 | 2 | 17 | 1 |
| **Dist. 3 total** | **6,722** | **6,286** | **6,320** | **7,161** | **88.3** | **3,152** | **64** | **3,088** | **104** | **627** | **1,350** | **413** |
| **Dist. 4 total** | **512** | **509** | **513** | **556** | **92.3** | **251** | **46** | **205** | **16** | **24** | **127** | **10** |
| **Dist. 5 total** | **3,036** | **2,900** | **2,922** | **3,019** | **96.8** | **1,372** | **238** | **1,134** | **41** | **394** | **502** | **395** |
| **August 31, 1990** | **15,116** | **14,176** | **14,276** | **15,516** | **92.0** | **7,320** | **412** | **6,908** | **180** | **1,266** | **3,058** | **972** |
| **August 24, 1990†** | **15,381** | **14,143** | **14,340** | **15,516** | **92.4** | **7,216** | **393** | **6,823** | **186** | **1,255** | **3,118** | **930** |
| **September 1, 1989** | **15,289** | **14,106** | **14,291** | **15,576** | **91.8** | **7,073** | **710** | **6,363** | **221** | **1,219** | **3,059** | **916** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—September 28, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Motor gasoline | | | Jet fuel | | Fuel oils | |
| | | | | | | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,525 | 1,306 | 1,306 | 1,381 | 94.6 | 710 | 9 | 701 | 5 | 106 | 335 | 134 |
| App. Dist. 1 | 111 | 98 | 98 | 124 | 79.0 | 37 | 1 | 36 | — | — | 34 | 3 |
| **Dist. 1 total** | **1,636** | **1,404** | **1,404** | **1,505** | **93.3** | **747** | **10** | **737** | **5** | **106** | **369** | **137** |
| Ind., Ill., Ky. | 2,362 | 2,242 | 2,283 | 2,195 | 104.0 | 1,297 | 12 | 1,285 | 3 | 123 | 463 | 72 |
| Minn., Wis., Dak. | 355 | 343 | 347 | 343 | 101.2 | 195 | 4 | 191 | 1 | 16 | 100 | 9 |
| Okla., Kan., Mo. | 808 | 738 | 742 | 737 | 100.7 | 385 | 22 | 363 | 14 | 51 | 196 | 2 |
| **Dist. 2 total** | **3,525** | **3,323** | **3,372** | **3,275** | **103.0** | **1,877** | **38** | **1,839** | **18** | **190** | **759** | **83** |
| Inland Texas | 588 | 491 | 508 | 584 | 87.0 | 279 | 24 | 255 | 20 | 40 | 123 | 14 |
| Texas Gulf coast | 3,139 | 2,733 | 2,756 | 3,339 | 82.5 | 1,627 | 10 | 1,617 | 31 | 291 | 539 | 187 |
| La. Gulf Coast | 2,645 | 2,491 | 2,503 | 2,903 | 86.2 | 1,185 | 28 | 1,157 | 23 | 306 | 517 | 126 |
| N. La. and Ark. | 208 | 171 | 178 | 257 | 69.3 | 61 | — | 61 | 2 | 3 | 55 | 13 |
| New Mexico | 88 | 75 | 75 | 78 | 96.2 | 41 | 9 | 32 | 12 | 1 | 19 | 1 |
| **Dist. 3 total** | **6,668** | **5,961** | **6,020** | **7,161** | **84.1** | **3,193** | **71** | **3,122** | **88** | **641** | **1,253** | **341** |
| **Dist. 4 total** | **515** | **494** | **494** | **556** | **88.8** | **229** | **51** | **178** | **19** | **36** | **143** | **10** |
| **Dist. 5 total** | **2,896** | **2,780** | **2,855** | **3,019** | **94.6** | **1,281** | **201** | **1,080** | **59** | **346** | **431** | **390** |
| **September 28, 1990** | **15,240** | **13,962** | **14,145** | **15,516** | **91.2** | **7,327** | **371** | **6,956** | **189** | **1,319** | **2,955** | **961** |
| **September 21, 1990†** | **15,172** | **14,262** | **14,405** | **15,516** | **92.8** | **7,214** | **283** | **6,931** | **225** | **1,337** | **2,921** | **901** |
| **September 29, 1989** | **15,015** | **13,764** | **13,923** | **15,576** | **89.4** | **6,877** | **633** | **6,244** | **240** | **1,168** | **2,922** | **849** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—October 26, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Motor gasoline | | | Jet fuel | | Fuel oils | |
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,246 | 980 | 1,001 | 1,384 | 72.3 | 500 | 1 | 499 | 14 | 106 | 312 | 86 |
| App. Dist. 1 | 112 | 104 | 105 | 124 | 84.7 | 43 | — | 43 | — | — | 32 | 2 |
| **Dist. 1 total** | **1,358** | **1,084** | **1,106** | **1,508** | **73.3** | **543** | **1** | **542** | **14** | **106** | **344** | **88** |
| Ind., Ill., Ky. | 2,060 | 1,886 | 1,886 | 2,195 | 85.9 | 1,188 | — | 1,188 | 5 | 126 | 446 | 36 |
| Minn., Wis., Dak. | 342 | 320 | 323 | 343 | 94.2 | 172 | 8 | 164 | 1 | 27 | 84 | 7 |
| Okla., Kan., Mo. | 672 | 601 | 605 | 737 | 82.1 | 336 | 10 | 326 | 3 | 51 | 159 | 4 |
| **Dist. 2 total** | **3,074** | **2,807** | **2,814** | **3,275** | **85.9** | **1,696** | **18** | **1,678** | **9** | **204** | **689** | **47** |
| Inland Texas | 561 | 506 | 506 | 584 | 86.6 | 303 | 19 | 284 | 22 | 45 | 137 | 15 |
| Texas Gulf coast | 3,309 | 2,832 | 2,916 | 3,339 | 87.3 | 1,404 | 15 | 1,389 | 48 | 281 | 670 | 149 |
| La. Gulf Coast | 2,522 | 2,305 | 2,338 | 2,903 | 80.5 | 1,186 | 63 | 1,123 | 18 | 347 | 475 | 117 |
| N. La. and Ark. | 180 | 162 | 169 | 257 | 65.8 | 66 | — | 66 | 4 | 6 | 48 | 3 |
| New Mexico | 49 | 43 | 44 | 78 | 56.4 | 41 | 8 | 33 | 2 | 1 | 11 | 2 |
| **Dist. 3 total** | **6,621** | **5,848** | **5,973** | **7,161** | **83.4** | **3,000** | **105** | **2,895** | **94** | **680** | **1,341** | **286** |
| **Dist. 4 total** | **478** | **441** | **445** | **556** | **80.0** | **218** | **51** | **167** | **16** | **24** | **136** | **15** |
| **Dist. 5 total** | **2,726** | **2,424** | **2,530** | **3,091** | **81.9** | **1,301** | **234** | **1,067** | **37** | **382** | **427** | **310** |
| **October 26, 1990** | **14,257** | **12,604** | **12,868** | **15,591** | **82.5** | **6,758** | **409** | **6,349** | **170** | **1,396** | **2,937** | **746** |
| **October 19, 1990†** | **14,358** | **12,769** | **12,987** | **15,591** | **83.3** | **6,856** | **375** | **6,481** | **168** | **1,473** | **2,886** | **788** |
| **October 27, 1989** | **14,434** | **13,270** | **13,483** | **15,576** | **86.6** | **6,787** | **546** | **6,241** | **188** | **1,260** | **2,941** | **1,023** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—November 30, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Motor gasoline | | | Jet fuel | | Fuel oils | |
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,404 | 1,110 | 1,132 | 1,384 | 81.8 | 608 | 6 | 602 | 6 | 88 | 299 | 127 |
| App. Dist. 1 | 95 | 93 | 93 | 124 | 75.0 | 38 | 1 | 37 | — | — | 27 | 1 |
| **Dist. 1 total** | **1,499** | **1,203** | **1,225** | **1,508** | **81.2** | **646** | **7** | **639** | **6** | **88** | **326** | **128** |
| Ind., Ill., Ky. | 2,125 | 1,990 | 2,004 | 2,195 | 91.3 | 1,248 | 14 | 1,234 | 10 | 126 | 469 | 48 |
| Minn., Wis., Dak. | 324 | 335 | 337 | 343 | 98.3 | 198 | 5 | 193 | 2 | 15 | 224 | 8 |
| Okla., Kan., Mo. | 764 | 697 | 700 | 737 | 95.0 | 425 | 15 | 410 | 5 | 41 | 191 | 5 |
| **Dist. 2 total** | **3,213** | **3,022** | **3,041** | **3,275** | **92.9** | **1,871** | **34** | **1,837** | **17** | **182** | **884** | **61** |
| Inland Texas | 625 | 536 | 558 | 584 | 95.5 | 325 | 18 | 307 | 15 | 51 | 141 | 13 |
| Texas Gulf Coast | 3,196 | 2,831 | 2,902 | 3,339 | 86.9 | 1,551 | 14 | 1,537 | 55 | 344 | 597 | 237 |
| La. Gulf Coast | 2,779 | 2,531 | 2,576 | 2,903 | 88.7 | 1,326 | — | 1,326 | 23 | 365 | 588 | 121 |
| N. La. and Ark. | 160 | 156 | 156 | 257 | 60.7 | 64 | — | 64 | 4 | 1 | 48 | 9 |
| New Mexico | 82 | 73 | 73 | 78 | 93.6 | 38 | 10 | 28 | 12 | 3 | 17 | 1 |
| **Dist. 3 total** | **6,842** | **6,127** | **6,265** | **7,161** | **87.5** | **3,304** | **42** | **3,262** | **109** | **764** | **1,391** | **381** |
| **Dist. 4 total** | **489** | **445** | **445** | **556** | **80.0** | **252** | **51** | **201** | **13** | **38** | **140** | **7** |
| **Dist. 5 total** | **2,862** | **2,692** | **2,738** | **3,091** | **88.6** | **1,226** | **154** | **1,072** | **64** | **388** | **476** | **282** |
| **November 30, 1990** | **14,905** | **13,489** | **13,714** | **15,591** | **88.0** | 7,299 | **288** | 7,011 | **209** | **1,460** | 3,217 | **859** |
| **November 23, 1990†** | **14,005** | **12,780** | **12,945** | **15,591** | **83.0** | **6,638** | **304** | **6,334** | **174** | **1,370** | **2,840** | **839** |
| **December 1, 1989** | **14,957** | **13,549** | **13,657** | **15,576** | **87.7** | 7,207 | **583** | **6,624** | **189** | **1,314** | **3,213** | **1,066** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API refinery report—December 21, 1990

| | Refinery operations (Thousands of barrels daily) | | | | | Refinery output (Thousands of barrels daily) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Motor gasoline | | | Jet fuel | | Fuel oils | |
| District | Total refinery input | Crude runs | Input to crude stills | Operable capacity | % operated | Total | Leaded* | Unleaded* | Naphtha | Kero | Distillate | Residual |
| East coast | 1,257 | 1,021 | 1,021 | 1,384 | 73.8 | 612 | — | 612 | 10 | 76 | 321 | 144 |
| App. Dist. 1 | 92 | 89 | 90 | 124 | 72.6 | 41 | 1 | 40 | — | — | 25 | 3 |
| **Dist. 1 total** | **1,349** | **1,110** | **1,111** | **1,508** | **73.7** | **653** | **1** | **652** | **10** | **76** | **346** | **147** |
| Ind., Ill., Ky. | 2,059 | 1,852 | 1,893 | 2,195 | 86.2 | 1,214 | 7 | 1,207 | 4 | 166 | 433 | 79 |
| Minn., Wis., Dak. | 331 | 321 | 322 | 343 | 93.9 | 161 | 3 | 158 | 1 | 22 | 88 | 7 |
| Okla., Kan., Mo. | 722 | 653 | 664 | 737 | 90.1 | 381 | 31 | 350 | — | 56 | 181 | 5 |
| **Dist. 2 total** | **3,112** | **2,826** | **2,879** | **3,275** | **87.9** | **1,756** | **41** | **1,715** | **5** | **244** | **702** | **91** |
| Inland Texas | 581 | 504 | 518 | 584 | 88.7 | 331 | 13 | 318 | 18 | 47 | 137 | 18 |
| Texas Gulf coast | 3,294 | 2,889 | 2,935 | 3,339 | 87.9 | 1,638 | — | 1,638 | 42 | 331 | 671 | 220 |
| La. Gulf Coast | 2,490 | 2,272 | 2,279 | 2,903 | 78.5 | 1,145 | — | 1,145 | 12 | 312 | 446 | 184 |
| N. La. and Ark. | 205 | 179 | 179 | 257 | 69.6 | 67 | — | 67 | 6 | 1 | 56 | 11 |
| New Mexico | 79 | 71 | 71 | 78 | 91.0 | 45 | 10 | 35 | 12 | 1 | 17 | — |
| **Dist. 3 total** | **6,649** | **5,915** | **5,982** | **7,161** | **83.5** | **3,226** | **23** | **3,203** | **90** | **692** | **1,327** | **433** |
| **Dist. 4 total** | **485** | **438** | **463** | **556** | **83.3** | **198** | **48** | **150** | **18** | **30** | **110** | **10** |
| **Dist. 5 total** | **2,748** | **2,567** | **2,637** | **3,091** | **85.3** | **1,258** | **168** | **1,090** | **44** | **383** | **440** | **333** |
| **December 21, 1990** | **14,343** | **12,856** | **13,072** | **15,591** | **83.8** | **7,091** | **281** | **6,810** | **167** | **1,425** | **2,925** | **1,014** |
| **December 14, 1990†** | **14,179** | **12,753** | **13,066** | **15,591** | **83.8** | **6,759** | **267** | **6,492** | **179** | **1,315** | **2,927** | **979** |
| **December 22, 1989** | **14,787** | **13,822** | **14,004** | **15,591** | **89.8** | **6,945** | **481** | **6,464** | **239** | **1,260** | **3,498** | **1,239** |

*Included in total motor gasoline. †Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | Crude oil | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 14,792 | 59,435 | 690 | 54,545 | 4,200 | 1,433 | 7,490 | 42,523 | 21,154 | 11,850 |
| PAD II | 69,876 | 63,112 | 5,907 | 49,523 | 7,682 | 757 | 7,299 | 34,678 | 3,672 | 15,651 |
| PAD III | 168,175 | 63,598 | 2,362 | 45,390 | 15,846 | 2,061 | 14,251 | 25,077 | 15,320 | 52,666 |
| PAD IV | 12,753 | 7,951 | 1,811 | 3,568 | 2,572 | 373 | 659 | 2,903 | 525 | 2,620 |
| **PAD I-IV** | **265,596** | **194,096** | **10,770** | **153,026** | **30,300** | **4,624** | **29,699** | **105,181** | **40,671** | **82,787** |
| PAD V | 77,770* | 32,668 | 6,037 | 17,976 | 8,655 | 1,899 | 7,043 | 11,323 | 7,124 | 22,856 |
| **January 26, 1990** | **343,366*** | **226,764** | **16,807** | **171,002** | **38,955** | **6,523** | **36,742** | **116,504** | **47,795** | **105,643** |
| **January 19, 1990§** | **344,044** | **219,479** | **17,092** | **164,127** | **38,260** | **6,427** | **35,506** | **111,802** | **45,899** | **104,586** |
| **January 27, 1989** | **325,636** | **240,047** | **40,264** | **157,889** | **41,894** | **6,467** | **36,759** | **120,551** | **45,414** | **100,146** |

*Includes 21,519 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | Crude oil | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 14,945 | 65,255 | 325 | 59,531 | 5,399 | 1,150 | 8,856 | 44,803 | 24,063 | 12,921 |
| PAD II | 70,195 | 67,537 | 5,250 | 51,923 | 10,364 | 833 | 8,547 | 32,832 | 3,743 | 14,956 |
| PAD III | 168,022 | 69,752 | 1,934 | 51,017 | 16,801 | 2,238 | 14,487 | 24,087 | 15,117 | 51,961 |
| PAD IV | 13,169 | 8,756 | 1,948 | 3,897 | 2,911 | 381 | 712 | 3,180 | 455 | 2,642 |
| **PAD I-IV** | **266,331** | **211,300** | **9,457** | **166,368** | **35,475** | **4,602** | **32,602** | **104,902** | **43,378** | **82,480** |
| PAD V | 75,651* | 32,150 | 5,423 | 17,349 | 9,378 | 1,721 | 6,713 | 12,044 | 6,918 | 25,241 |
| **February 23, 1990** | **341,982*** | **243,450** | **14,880** | **183,717** | **44,853** | **6,323** | **39,315** | **116,946** | **50,296** | **107,721** |
| **February 16, 1990§** | **344,910** | **240,995** | **15,937** | **181,997** | **43,061** | **6,097** | **39,689** | **119,266** | **49,892** | **106,302** |
| **February 24, 1989** | **323,706** | **247,590** | **40,160** | **163,578** | **43,852** | **6,265** | **36,210** | **109,225** | **44,945** | **103,796** |

*Includes 21,578 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | Crude oil | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 14,129 | 64,892 | 189 | 58,821 | 5,882 | 726 | 9,482 | 34,282 | 20,085 | 12,170 |
| PAD II | 76,431 | 62,951 | 4,753 | 48,351 | 9,847 | 883 | 9,224 | 31,282 | 3,653 | 15,757 |
| PAD III | 172,682 | 66,761 | 1,706 | 48,653 | 16,402 | 2,529 | 13,342 | 22,765 | 14,539 | 52,610 |
| PAD IV | 13,824 | 8,287 | 1,966 | 3,525 | 2,796 | 694 | 740 | 3,089 | 426 | 2,287 |
| **PAD I-IV** | **277,066** | **202,891** | **8,614** | **159,350** | **34,927** | **4,832** | **32,788** | **91,418** | **38,703** | **82,824** |
| PAD V | 81,397* | 32,514 | 5,541 | 18,409 | 8,564 | 2,021 | 7,186 | 12,228 | 6,643 | 26,160 |
| **March 23, 1990** | **358,463*** | **235,405** | **14,155** | **177,759** | **43,491** | **6,853** | **39,974** | **103,646** | **45,346** | **108,984** |
| **March 16, 1990§** | **350,983** | **241,159** | **14,617** | **182,778** | **43,764** | **7,079** | **39,470** | **105,894** | **46,270** | **109,375** |
| **March 24, 1989** | **337,425** | **236,455** | **35,174** | **162,477** | **38,804** | **6,192** | **36,961** | **96,231** | **38,868** | **106,509** |

*Includes 20,040 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | Crude oil | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 15,928 | 61,069 | 164 | 55,874 | 5,031 | 886 | 10,352 | 28,706 | 18,267 | 11,281 |
| PAD II | 80,348 | 60,556 | 4,096 | 47,529 | 8,931 | 875 | 9,460 | 29,895 | 3,755 | 16,130 |
| PAD III | 179,653 | 59,898 | 1,360 | 43,657 | 14,881 | 2,251 | 13,943 | 23,384 | 13,330 | 51,945 |
| PAD IV | 14,317 | 7,536 | 1,662 | 3,669 | 2,205 | 455 | 828 | 2,820 | 499 | 2,542 |
| **PAD I-IV** | **290,246** | **189,059** | **7,282** | **150,729** | **31,048** | **4,467** | **34,583** | **84,805** | **35,851** | **81,898** |
| PAD V | 82,197* | 31,952 | 5,347 | 18,230 | 8,375 | 1,936 | 7,593 | 11,115 | 8,040 | 25,272 |
| **April 27, 1990** | **372,443*** | **221,011** | **12,629** | **168,959** | **39,423** | **6,403** | **42,176** | **95,920** | **43,891** | **107,170** |
| **April 20, 1990§** | **372,916** | **222,492** | **12,837** | **169,371** | **40,284** | **6,651** | **42,409** | **97,970** | **42,291** | **108,579** |
| **April 28, 1989** | **335,724** | **222,742** | **29,123** | **154,547** | **39,072** | **5,894** | **38,605** | **96,119** | **41,579** | **111,510** |

*Includes 22,966 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 15,904 | 61,170 | 120 | 56,643 | 4,407 | 1,042 | 10,711 | 31,661 | 18,874 | 11,705 |
| PAD II | 84,234 | 58,099 | 4,038 | 45,626 | 8,435 | 809 | 9,304 | 29,423 | 3,533 | 17,254 |
| PAD III | 186,255 | 58,313 | 1,068 | 42,058 | 15,187 | 2,199 | 14,114 | 23,632 | 13,663 | 54,333 |
| PAD IV | 13,724 | 7,133 | 1,673 | 3,399 | 2,061 | 412 | 772 | 3,067 | 451 | 2,391 |
| **PAD I-IV** | **300,117** | **184,715** | **6,899** | **147,726** | **30,090** | **4,462** | **34,901** | **87,783** | **36,521** | **85,683** |
| PAD V | 81,700* | 29,507 | 5,289 | 16,563 | 7,655 | 1,892 | 7,120 | 12,175 | 7,992 | 27,105 |
| **May 25, 1990** | **381,817*** | **214,222** | **12,188** | **164,289** | **37,745** | **6,354** | **42,021** | **99,958** | **44,513** | **112,788** |
| **May 18, 1990§** | **379,708** | **213,167** | **11,771** | **163,750** | **37,646** | **6,572** | **41,068** | **99,221** | **43,452** | **110,360** |
| **May 26, 1989** | **341,296** | **221,701** | **26,596** | **155,580** | **39,525** | **5,563** | **38,252** | **95,344** | **38,252** | **113,238** |

*Includes 20,347 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 15,231 | 60,628 | 256 | 55,575 | 4,797 | 1,060 | 11,579 | 37,607 | 19,766 | 12,666 |
| PAD II | 84,472 | 59,513 | 3,873 | 47,432 | 8,208 | 1,104 | 8,802 | 31,218 | 3,714 | 18,317 |
| PAD III | 185,710 | 61,517 | 1,332 | 42,613 | 17,572 | 2,239 | 13,251 | 26,335 | 13,602 | 55,068 |
| PAD IV | 13,466 | 6,773 | 1,459 | 3,558 | 1,756 | 305 | 829 | 3,273 | 481 | 2,349 |
| **PAD I-IV** | **298,879** | **188,431** | **6,920** | **149,178** | **32,333** | **4,708** | **34,461** | **98,433** | **37,563** | **88,400** |
| PAD V | 84,995* | 27,807 | 4,656 | 15,891 | 7,260 | 2,066 | 6,438 | 11,372 | 6,819 | 27,603 |
| **June 22, 1990** | **383,874*** | **216,238** | **11,576** | **165,069** | **39,593** | **6,774** | **40,899** | **109,805** | **44,382** | **116,003** |
| **June 15, 1990** | **384,405** | **216,592** | **11,405** | **165,670** | **39,517** | **7,015** | **40,918** | **107,437** | **45,571** | **116,816** |
| **June 23, 1989** | **342,394** | **218,818** | **24,832** | **154,324** | **39,662** | **6,297** | **39,770** | **99,065** | **41,582** | **111,855** |

*Includes 20,599 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 16,080 | 59,730 | 149 | 54,677 | 4,904 | 840 | 12,877 | 44,240 | 19,261 | 14,238 |
| PAD II | 83,524 | 57,531 | 3,040 | 46,462 | 8,029 | 1,087 | 8,555 | 32,110 | 3,196 | 17,551 |
| PAD III | 185,759 | 64,182 | 880 | 45,636 | 17,666 | 2,379 | 16,323 | 28,193 | 12,908 | 52,165 |
| PAD IV | 12,728 | 6,315 | 1,458 | 3,094 | 1,763 | 330 | 915 | 3,254 | 530 | 1,996 |
| **PAD I-IV** | **298,091** | **187,758** | **5,527** | **149,869** | **32,362** | **4,636** | **38,670** | **107,797** | **35,895** | **85,950** |
| PAD V | 88,497* | 27,796 | 4,897 | 15,885 | 7,014 | 1,691 | 5,968 | 10,816 | 8,847 | 26,396 |
| **July 27, 1990** | **386,588*** | **215,554** | **10,424** | **165,754** | **39,376** | **6,327** | **44,638** | **118,613** | **44,742** | **112,346** |
| **July 20, 1990§** | **383,652** | **216,274** | **10,560** | **167,200** | **38,514** | **6,219** | **43,325** | **117,128** | **45,104** | **113,544** |
| **July 28, 1989** | **330,075** | **225,950** | **24,892** | **160,576** | **40,492** | **6,301** | **41,263** | **111,500** | **42,186** | **107,092** |

*Includes 22,555 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 15,820 | 60,272 | 124 | 56,034 | 4,114 | 1,134 | 10,999 | 51,565 | 21,049 | 13,192 |
| PAD II | 82,328 | 55,007 | 3,463 | 43,806 | 7,738 | 1,014 | 8,481 | 30,769 | 3,651 | 17,324 |
| PAD III | 182,505 | 61,916 | 959 | 44,312 | 16,645 | 1,937 | 15,436 | 29,382 | 15,806 | 52,708 |
| PAD IV | 11,168 | 5,692 | 1,220 | 2,804 | 1,668 | 351 | 737 | 2,788 | 534 | 2,073 |
| **PAD I-IV** | **291,821** | **182,887** | **5,766** | **146,956** | **30,165** | **4,436** | **35,653** | **114,504** | **41,040** | **85,297** |
| PAD V | 80,380* | 27,572 | 4,566 | 15,296 | 7,710 | 1,492 | 6,329 | 12,167 | 8,189 | 26,051 |
| **August 31, 1990** | **372,201*** | **210,459** | **10,332** | **162,252** | **37,875** | **5,928** | **41,982** | **126,671** | **49,229** | **111,348** |
| **August 24, 1990§** | **376,607** | **210,851** | **9,925** | **162,467** | **38,459** | **5,958** | **43,249** | **124,049** | **48,273** | **109,384** |
| **September 1, 1989** | **335,797** | **217,725** | **22,193** | **156,501** | **39,031** | **6,169** | **41,711** | **116,792** | **42,156** | **105,695** |

*Includes 21,457 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 15,809 | 62,731 | 60 | 59,088 | 3,583 | 966 | 11,118 | 62,061 | 23,952 | 13,529 |
| PAD II | 75,334 | 59,089 | 3,426 | 46,809 | 8,854 | 1,058 | 9,272 | 29,467 | 3,820 | 17,462 |
| PAD III | 181,748 | 63,670 | 766 | 45,598 | 17,306 | -2,057 | 13,921 | 28,924 | 15,667 | 54,374 |
| PAD IV | 10,239 | 6,510 | 1,212 | 2,936 | 2,362 | 437 | 777 | 2,612 | 501 | 2,098 |
| **PAD I-IV** | **283,130** | **192,000** | **5,464** | **154,431** | **32,105** | **4,518** | **35,088** | **123,064** | **43,940** | **87,463** |
| PAD V | 71,514* | 31,892 | 5,599 | 17,577 | 8,716 | 1,552 | 7,055 | 11,743 | 7,548 | 25,633 |
| **September 28, 1990** | **354,644*** | **223,892** | **11,063** | **172,008** | **40,821** | **6,070** | **42,143** | **134,807** | **51,488** | **113,096** |
| **September 21, 1990§** | **364,012** | **222,263** | **10,760** | **171,364** | **40,139** | **6,094** | **42,265** | **136,495** | **52,219** | **113,303** |
| **September 29, 1989** | **333,340** | **223,741** | **21,774** | **161,715** | **40,252** | **6,947** | **40,065** | **122,923** | **44,792** | **105,116** |

*Includes 16,136 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 15,952 | 59,835 | 61 | 54,857 | 4,917 | 804 | 11,914 | 65,163 | 24,351 | 13,067 |
| PAD II | 70,918 | 58,833 | 2,757 | 48,022 | 8,054 | 1,009 | 8,422 | 29,562 | 4,425 | 15,954 |
| PAD III | 164,529 | 64,024 | 801 | 46,911 | 16,312 | 2,260 | 16,615 | 29,652 | 14,269 | 50,904 |
| PAD IV | 11,712 | 6,512 | 1,424 | 3,139 | 1,949 | 392 | 624 | 2,573 | 615 | 2,103 |
| **PAD I-IV** | **263,111** | **189,204** | **5,043** | **152,929** | **31,232** | **4,465** | **37,575** | **126,950** | **43,660** | **82,028** |
| PAD V | 76,367* | 31,201 | 5,709 | 16,347 | 7,145 | 1,909 | 7,650 | 11,136 | 6,520 | 24,959 |
| **October 26, 1990** | **339,478*** | **220,405** | **10,752** | **171,276** | **38,377** | **6,364** | **45,225** | **138,086** | **50,180** | **106,987** |
| **October 19, 1990§** | **340,381** | **222,605** | **10,635** | **172,503** | **39,467** | **6,400** | **44,542** | **136,881** | **49,645** | **108,772** |
| **October 27, 1989** | **345,363** | **223,164** | **20,706** | **163,615** | **38,843** | **5,861** | **43,392** | **118,658** | **48,790** | **111,537** |

*Includes 15,406 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 12,971 | 57,868 | 47 | 52,923 | 4,898 | 937 | 13,212 | 62,424 | 23,643 | 13,785 |
| PAD II | 69,828 | 55,608 | 2,586 | 45,153 | 7,869 | 901 | 8,854 | 29,018 | 3,696 | 14,867 |
| PAD III | 167,610 | 66,615 | 803 | 49,173 | 16,639 | 2,400 | 16,433 | 27,965 | 15,636 | 52,306 |
| PAD IV | 12,607 | 7,557 | 1,518 | 3,766 | 2,273 | 297 | 650 | 2,932 | 584 | 2,041 |
| **PAD I-IV** | **263,016** | **187,648** | **4,954** | **151,015** | **31,679** | **4,535** | **39,149** | **122,339** | **43,559** | **82,999** |
| PAD V | 74,059* | 30,624 | 5,363 | 17,986 | 7,275 | 1,553 | 7,679 | 12,462 | 7,867 | 24,720 |
| **November 23, 1990** | **337,075*** | **218,272** | **10,317** | **169,001** | **38,954** | **6,088** | **46,828** | **134,801** | **51,426** | **107,719** |
| **November 16, 1990§** | **341,215** | **217,331** | **9,987** | **168,393** | **38,951** | **5,791** | **43,682** | **134,535** | **51,410** | **106,408** |
| **November 24, 1989** | **344,033** | **222,122** | **18,117** | **165,826** | **38,179** | **6,040** | **43,777** | **119,565** | **51,077** | **112,639** |

*Includes 17,700 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API crude and product stocks

(Thousands of barrels)

| | | Motor gasoline | | | | Jet fuels | | Fuel oils | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Total | Leaded† | Unleaded† | Blending Comp.† | Naphtha | Kerosine | Distillate | Residual | Unfinished oils |
| PAD I | 16,687 | 58,773 | 125 | 53,837 | 4,811 | 773 | 12,698 | 55,949 | 23,076 | 13,043 |
| PAD II | 70,580 | 56,586 | 2,645 | 46,157 | 7,784 | 1,031 | 9,456 | 31,846 | 3,144 | 14,200 |
| PAD III | 157,795 | 68,185 | 701 | 52,173 | 15,311 | 2,101 | 15,044 | 27,842 | 14,766 | 47,741 |
| PAD IV | 12,851 | 7,877 | 1,419 | 3,991 | 2,467 | 355 | 840 | 2,957 | 512 | 1,808 |
| **PAD I-IV** | **257,913** | **191,421** | **4,890** | **156,158** | **30,373** | **4,260** | **38,038** | **118,594** | **41,498** | **76,792** |
| PAD V | 76,802* | 32,243 | 5,149 | 18,771 | 8,323 | 1,821 | 7,185 | 12,879 | 7,763 | 25,291 |
| **December 21, 1990** | **334,715*** | **223,664** | **10,039** | **174,929** | **38,696** | **6,081** | **45,223** | **131,473** | **49,261** | **102,083** |
| **December 14, 1990§** | **331,458** | **224,623** | **9,509** | **175,727** | **39,387** | **5,832** | **45,080** | **132,644** | **48,671** | **104,692** |
| **December 22, 1989** | **342,014** | **221,720** | **18,297** | **166,090** | **37,333** | **5,946** | **40,081** | **112,186** | **46,312** | **105,581** |

*Includes 18,777 bbl. of Alaskan crude in transit by water. †Included in total motor gasoline. §Revised
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 1–26 1990 | 1–19* 1990 | 1–26 1990 | 1–19* 1990 | 1–26 1990 | 1–19* 1990 | 1–27 1989 |
| Total motor gasoline | 378 | 464 | 7 | 6 | 385 | 470 | 415 |
| Leaded gasoline† | — | — | — | — | — | — | 6 |
| Unleaded gasoline† | 378 | 464 | 7 | 6 | 385 | 470 | 409 |
| Mo. gas. blending comp. | 58 | 62 | — | 2 | 58 | 64 | 86 |
| Distillate§ | 516 | 390 | 4 | 3 | 520 | 393 | 412 |
| Residual | 479 | 848 | 5 | 5 | 484 | 853 | 717 |
| Jet fuel-naphtha | 2 | 2 | — | — | 2 | 2 | 3 |
| Jet fuel-kerosine | 146 | 150 | 4 | 7 | 150 | 157 | 136 |
| LPG | 128 | 217 | 11 | 8 | 139 | 225 | 354 |
| Unfinished oils | 575 | 573 | 7 | 10 | 582 | 583 | 200 |
| Other | 179 | 337 | 1 | 2 | 180 | 339 | 187 |
| **Total products** | 2,461 | 3,043 | 39 | 43 | 2,500 | 3,086 | 2,610 |
| Canadian crude | 521 | 593 | — | 14 | 521 | 607 | 550 |
| Other foreign | 5,402 | 5,816 | 231 | 42 | 5,633 | 5,858 | 5,034 |
| **Total crude** | 5,923 | 6,409 | 231 | 56 | 6,154 | 6,465 | 5,584 |
| **Total imports** | 8,384 | 9,452 | 270 | 99 | 8,654 | 9,551 | 8,094 |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 2–23 1990 | 2–16* 1990 | 2–23 1990 | 2–16* 1990 | 2–23 1990 | 2–16* 1990 | 2–24 1989 |
| Total motor gasoline | 331 | 315 | 2 | 2 | 333 | 317 | 417 |
| Leaded gasoline† | — | — | — | — | — | — | 6 |
| Unleaded gasoline† | 331 | 315 | 2 | 2 | 333 | 317 | 411 |
| Mo. gas. blending comp. | 77 | — | — | — | 77 | — | 93 |
| Distillate§ | 395 | 269 | 1 | 10 | 396 | 279 | 490 |
| Residual | 620 | 611 | 5 | 19 | 625 | 630 | 676 |
| Jet fuel-naphtha | 2 | 1 | — | — | 2 | 1 | 3 |
| Jet fuel-kerosine | 201 | 53 | — | 7 | 201 | 60 | 191 |
| LPG | 267 | 134 | 7 | 5 | 274 | 139 | 204 |
| Unfinished oils | 485 | 583 | — | — | 485 | 583 | 245 |
| Other | 191 | 157 | 2 | 2 | 193 | 159 | 423 |
| **Total products** | 2,569 | 2,123 | 17 | 45 | 2,586 | 2,168 | 2,742 |
| Canadian crude | 586 | 620 | — | — | 586 | 620 | 671 |
| Other foreign | 4,936 | 4,461 | 204 | 226 | 5,140 | 4,687 | 4,120 |
| **Total crude** | 5,522 | 5,081 | 204 | 226 | 5,726 | 5,307 | 4,791 |
| **Total imports** | 8,091 | 7,204 | 221 | 271 | 8,312 | 7,475 | 7,533 |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 3–23 1990 | 3–16* 1990 | 3–23 1990 | 3–16* 1990 | 3–23 1990 | 3–16* 1990 | 3–24 1989 |
| Total motor gasoline | 228 | 344 | 1 | 2 | 229 | 346 | 419 |
| Leaded gasoline† | — | — | — | — | — | — | 2 |
| Unleaded gasoline† | 228 | 344 | 1 | 2 | 229 | 346 | 417 |
| Mo. gas. blending comp. | 8 | 67 | — | — | 8 | 67 | 28 |
| Distillate§ | 309 | 182 | 2 | 1 | 311 | 183 | 456 |
| Residual | 439 | 590 | 5 | 28 | 444 | 618 | 746 |
| Jet fuel-naphtha | 1 | 1 | — | — | 1 | 1 | 3 |
| Jet fuel-kerosine | 98 | 99 | 4 | — | 102 | 99 | 98 |
| LPG | 214 | 155 | 9 | 19 | 223 | 174 | 171 |
| Unfinished oils | 133 | 480 | — | — | 133 | 480 | 208 |
| Other | 309 | 427 | 3 | 4 | 312 | 431 | 208 |
| **Total products** | 1,739 | 2,345 | 24 | 54 | 1,763 | 2,399 | 2,337 |
| Canadian crude | 535 | 583 | 12 | — | 547 | 583 | 652 |
| Other foreign | 5,171 | 4,989 | 403 | 105 | 5,574 | 5,094 | 4,103 |
| **Total crude** | 5,706 | 5,572 | 415 | 105 | 6,121 | 5,677 | 4,755 |
| **Total imports** | 7,445 | 7,917 | 439 | 159 | 7,884 | 8,076 | 7,092 |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 4–27 1990 | 4–20* 1990 | 4–27 1990 | 4–20* 1990 | 4–27 1990 | 4–20* 1990 | 4–28 1989 |
| Total motor gasoline | 504 | 204 | 3 | 1 | 507 | 205 | 638 |
| Leaded gasoline† | 24 | — | — | — | 24 | — | 12 |
| Unleaded gasoline† | 480 | 204 | 3 | 1 | 483 | 205 | 626 |
| Mo. gas. blending comp. | 4 | 21 | — | — | 4 | 21 | 87 |
| Distillate§ | 338 | 327 | 1 | 5 | 339 | 332 | 224 |
| Residual | 604 | 497 | 80 | 10 | 684 | 507 | 974 |
| Jet fuel-naphtha | 1 | 1 | — | — | 1 | 1 | 7 |
| Jet fuel-kerosine | 90 | 96 | — | 5 | 90 | 101 | 132 |
| LPG | 225 | 145 | 4 | 8 | 229 | 153 | 144 |
| Unfinished oils | 265 | 412 | 4 | — | 269 | 412 | 377 |
| Other | 141 | 344 | 3 | 4 | 144 | 348 | 459 |
| **Total products** | 2,172 | 2,047 | 95 | 33 | 2,267 | 2,080 | 3,042 |
| Canadian crude | 622 | 559 | 5 | — | 627 | 559 | 622 |
| Other foreign | 5,167 | 4,817 | 317 | 341 | 5,484 | 5,158 | 5,258 |
| **Total crude** | 5,789 | 5,376 | 322 | 341 | 6,111 | 5,717 | 5,880 |
| **Total imports** | 7,961 | 7,423 | 417 | 374 | 8,378 | 7,797 | 8,922 |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 5–25 1990 | 5–18* 1990 | 5–25 1990 | 5–18* 1990 | 5–25 1990 | 5–18* 1990 | 5–26 1989 |
| Total motor gasoline | 529 | 386 | 30 | 37 | 559 | 423 | 520 |
| Leaded gasoline† | — | — | — | — | — | — | 80 |
| Unleaded gasoline† | 529 | 386 | 30 | 37 | 559 | 423 | 440 |
| Mo. gas. blending comp. | 25 | 40 | — | — | 25 | 40 | 57 |
| Distillate§ | 126 | 165 | 1 | 1 | 127 | 166 | 261 |
| Residual | 763 | 124 | 59 | 9 | 822 | 133 | 794 |
| Jet fuel-naphtha | 2 | 2 | — | — | 2 | 2 | 3 |
| Jet fuel-kerosine | 99 | 152 | — | 1 | 99 | 153 | 183 |
| LPG | 89 | 84 | 5 | 2 | 94 | 86 | 177 |
| Unfinished oils | 407 | 466 | 3 | 5 | 410 | 471 | 279 |
| Other | 325 | 247 | 3 | 2 | 328 | 249 | 299 |
| **Total products** | 2,365 | 1,666 | 101 | 57 | 2,466 | 1,723 | 2,573 |
| Canadian crude | 659 | 749 | 31 | 19 | 690 | 768 | 618 |
| Other foreign | 5,691 | 5,090 | 410 | 138 | 6,101 | 5,228 | 4,867 |
| **Total crude** | 6,350 | 5,839 | 441 | 157 | 6,791 | 5,996 | 5,485 |
| **Total imports** | 8,715 | 7,505 | 542 | 214 | 9,257 | 7,719 | 8,058 |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 6–22 1990 | 6–15* 1990 | 6–22 1990 | 6–15* 1990 | 6–22 1990 | 6–15* 1990 | 6–23 1989 |
| Total motor gasoline | 495 | 373 | 18 | 4 | 513 | 377 | 365 |
| Leaded gasoline† | — | 21 | — | — | — | 21 | 4 |
| Unleaded gasoline† | 495 | 352 | 18 | 4 | 513 | 356 | 361 |
| Mo. gas. blending comp. | 233 | 71 | 39 | — | 272 | 71 | 16 |
| Distillate§ | 367 | 239 | 4 | 3 | 371 | 242 | 169 |
| Residual | 668 | 625 | 34 | 10 | 702 | 635 | 263 |
| Jet fuel-naphtha | 1 | 2 | — | — | 1 | 2 | 3 |
| Jet fuel-kerosine | 112 | 114 | 2 | — | 114 | 114 | 130 |
| LPG | 103 | 260 | 2 | 5 | 105 | 265 | 202 |
| Unfinished oils | 571 | 431 | 2 | 2 | 573 | 433 | 478 |
| Other | 353 | 192 | 4 | 2 | 357 | 194 | 157 |
| **Total products** | 2,903 | 2,307 | 105 | 26 | 3,008 | 2,333 | 1,783 |
| Canadian crude | 617 | 729 | 8 | 8 | 625 | 737 | 671 |
| Other foreign | 5,614 | 6,123 | 269 | 189 | 5,883 | 6,312 | 5,644 |
| **Total crude** | 6,231 | 6,852 | 277 | 197 | 6,508 | 7,049 | 6,315 |
| **Total imports** | 9,134 | 9,159 | 382 | 223 | 9,516 | 9,382 | 8,098 |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 7-27 1990 | 7-20* 1990 | 7-27 1990 | 7-20* 1990 | 7-27 1990 | 7-20* 1990 | 7-28 1989 |
| Total motor gasoline | 393 | 416 | 9 | 32 | 402 | 448 | 441 |
| Leaded gasoline† | — | — | — | — | — | — | — |
| Unleaded gasoline† | 393 | 416 | 9 | 32 | 402 | 448 | 441 |
| Mo. gas. blending comp. | 59 | 55 | — | — | 59 | 55 | 15 |
| Distillate§ | 244 | 275 | 2 | 2 | 246 | 277 | 311 |
| Residual | 678 | 468 | 5 | 21 | 683 | 489 | 484 |
| Jet fuel-naphtha | 2 | 2 | — | — | 2 | 2 | 3 |
| Jet fuel-kerosine | 79 | 82 | 4 | 3 | 83 | 85 | 240 |
| LPG | 101 | 142 | 10 | 2 | 111 | 144 | 221 |
| Unfinished oils | 537 | 316 | 2 | 2 | 539 | 318 | 276 |
| Other | 143 | 170 | — | 2 | 143 | 172 | 44 |
| **Total products** | **2,236** | **1,926** | **32** | **64** | **2,268** | **1,990** | **2,035** |
| Canadian crude | 701 | 684 | — | — | 701 | 684 | 611 |
| Other foreign | 6,177 | 5,731 | 381 | 216 | 6,558 | 5,947 | 5,997 |
| **Total crude** | **6,878** | **6,415** | **381** | **216** | **7,259** | **6,631** | **6,608** |
| **Total imports** | **9,114** | **8,341** | **413** | **280** | **9,527** | **8,621** | **8,643** |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 8-31 1990 | 8-24* 1990 | 8-31 1990 | 8-24* 1990 | 8-31 1990 | 8-24* 1990 | 9-1 1989 |
| Total motor gasoline | 179 | 253 | 13 | 34 | 192 | 287 | 221 |
| Leaded gasoline† | — | — | — | — | — | — | — |
| Unleaded gasoline† | 179 | 253 | 13 | 34 | 192 | 287 | 221 |
| Mo. gas. blending comp. | 15 | 11 | — | — | 15 | 11 | 44 |
| Distillate§ | 352 | 357 | 2 | 3 | 354 | 360 | 222 |
| Residual | 615 | 883 | 2 | 4 | 617 | 887 | 462 |
| Jet fuel-naphtha | 2 | 2 | — | — | 2 | 2 | 4 |
| Jet fuel-kerosine | 49 | 27 | 1 | 1 | 50 | 28 | 77 |
| LPG | 257 | 54 | 7 | 3 | 264 | 57 | 165 |
| Unfinished oils | 267 | 275 | — | — | 267 | 275 | 532 |
| Other | 126 | 278 | 2 | 3 | 128 | 281 | 11 |
| **Total products** | **1,862** | **2,140** | **27** | **48** | **1,889** | **2,188** | **1,738** |
| Canadian crude | 703 | 662 | — | — | 703 | 662 | 574 |
| Other foreign | 5,938 | 5,661 | 126 | 320 | 6,064 | 5,981 | 5,872 |
| **Total crude** | **6,641** | **6,323** | **126** | **320** | **6,767** | **6,643** | **6,446** |
| **Total imports** | **8,503** | **8,463** | **153** | **368** | **8,656** | **8,831** | **8,184** |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 9-28 1990 | 9-21* 1990 | 9-28 1990 | 9-21* 1990 | 9-28 1990 | 9-21* 1990 | 9-29 1989 |
| Total motor gasoline | 450 | 212 | 30 | 3 | 480 | 215 | 301 |
| Leaded gasoline† | — | 19 | — | — | — | 19 | — |
| Unleaded gasoline† | 450 | 193 | 30 | 3 | 480 | 196 | 301 |
| Mo. gas. blending comp. | 78 | 75 | — | — | 78 | 75 | 200 |
| Distillate§ | 335 | 219 | 2 | 1 | 337 | 220 | 95 |
| Residual | 269 | 364 | 8 | — | 277 | 364 | 426 |
| Jet fuel-naphtha | 2 | 2 | — | — | 2 | 2 | 12 |
| Jet fuel-kerosine | 86 | 72 | 3 | — | 89 | 72 | 49 |
| LPG | 193 | 147 | 9 | 6 | 202 | 153 | 203 |
| Unfinished oils | 494 | 228 | — | — | 494 | 228 | 474 |
| Other | 423 | 174 | 5 | 1 | 428 | 175 | 55 |
| **Total products** | **2,330** | **1,493** | **57** | **11** | **2,387** | **1,504** | **1,815** |
| Canadian crude | 638 | 692 | 11 | — | 649 | 692 | 623 |
| Other foreign | 4,287 | 4,776 | 123 | 206 | 4,410 | 4,982 | 5,703 |
| **Total crude** | **4,925** | **5,468** | **134** | **206** | **5,059** | **5,674** | **6,326** |
| **Total imports** | **7,255** | **6,961** | **191** | **217** | **7,446** | **7,178** | **8,141** |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 10-26 1990 | 10-19* 1990 | 10-26 1990 | 10-19* 1990 | 10-26 1990 | 10-19* 1990 | 10-27 1989 |
| Total motor gasoline | 334 | 182 | 52 | 4 | 386 | 186 | 319 |
| Leaded gasoline† | — | — | — | — | — | — | — |
| Unleaded gasoline† | 334 | 182 | 52 | 4 | 386 | 186 | 319 |
| Mo. gas. blending comp. | 11 | 27 | — | — | 11 | 27 | 188 |
| Distillate§ | 320 | 269 | 2 | 2 | 322 | 271 | 204 |
| Residual | 325 | 453 | 43 | 6 | 368 | 459 | 776 |
| Jet fuel-naphtha | 2 | 2 | — | — | 2 | 2 | 4 |
| Jet fuel-kerosine | 19 | 20 | — | 1 | 19 | 21 | 48 |
| LPG | 119 | 132 | 3 | 9 | 122 | 141 | 174 |
| Unfinished oils | 273 | 396 | — | — | 273 | 396 | 282 |
| Other | 203 | 96 | 2 | 1 | 205 | 97 | 78 |
| **Total products** | **1,606** | **1,577** | **102** | **23** | **1,708** | **1,600** | **2,873** |
| Canadian crude | 680 | 666 | 52 | 10 | 732 | 676 | 587 |
| Other foreign | 4,082 | 4,010 | 250 | 145 | 4,332 | 4,155 | 6,357 |
| **Total crude** | **4,762** | **4,676** | **302** | **155** | **5,064** | **4,831** | **6,944** |
| **Total imports** | **6,368** | **6,253** | **404** | **178** | **6,772** | **6,431** | **9,017** |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 11-30 1990 | 11-23* 1990 | 11-30 1990 | 11-23* 1990 | 11-30 1990 | 11-23* 1990 | 12-1 1989 |
| Total motor gasoline | 351 | 265 | 12 | 7 | 363 | 272 | 431 |
| Leaded gasoline† | — | — | — | — | — | — | — |
| Unleaded gasoline† | 351 | 265 | 12 | 7 | 363 | 272 | 431 |
| Mo. gas. blending comp. | 62 | 48 | 3 | 4 | 65 | 52 | 11 |
| Distillate§ | 267 | 194 | 4 | 2 | 271 | 196 | 449 |
| Residual | 366 | 280 | 11 | 16 | 377 | 296 | 414 |
| Jet fuel-naphtha | 37 | 25 | — | — | 37 | 25 | — |
| Jet fuel-kerosine | 77 | 58 | 7 | 4 | 84 | 62 | 181 |
| LPG | 120 | 238 | 1 | 13 | 121 | 251 | 134 |
| Unfinished oils | 580 | 385 | 1 | 1 | 581 | 386 | 283 |
| Other | 270 | 157 | — | 13 | 270 | 170 | 151 |
| **Total products** | **2,130** | **1,650** | **39** | **60** | **2,169** | **1,710** | **2,054** |
| Canadian crude | 604 | 578 | — | — | 604 | 578 | 697 |
| Other foreign | 4,330 | 4,510 | 57 | 165 | 4,387 | 4,675 | 6,030 |
| **Total crude** | **4,934** | **5,088** | **57** | **165** | **4,991** | **5,253** | **6,727** |
| **Total imports** | **7,064** | **6,738** | **96** | **225** | **7,160** | **6,963** | **8,781** |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

## API imports of crude and products

(Thousands of barrels daily)

| | Districts 1-4 | | District 5 | | Total U.S. | | |
|---|---|---|---|---|---|---|---|
| | 12-21 1990 | 12-14* 1990 | 12-21 1990 | 12-14* 1990 | 12-21 1990 | 12-14* 1990 | 12-22 1989 |
| Total motor gasoline | 238 | 465 | 3 | 9 | 241 | 474 | 378 |
| Leaded gasoline† | — | — | — | — | — | — | — |
| Unleaded gasoline† | 238 | 465 | 3 | 9 | 241 | 474 | 378 |
| Mo. gas. blending comp. | 7 | 13 | — | — | 7 | 13 | 13 |
| Distillate§ | 261 | 160 | 7 | 2 | 268 | 162 | 433 |
| Residual | 188 | 377 | 9 | 14 | 197 | 391 | 323 |
| Jet fuel-naphtha | 20 | — | — | — | 20 | — | 3 |
| Jet fuel-kerosine | 33 | 87 | — | 7 | 33 | 94 | 90 |
| LPG | 165 | 103 | 5 | 6 | 170 | 109 | 186 |
| Unfinished oils | 445 | 514 | 2 | — | 447 | 514 | 353 |
| Other | 83 | 296 | 2 | 8 | 85 | 304 | 9 |
| **Total products** | **1,440** | **2,015** | **28** | **46** | **1,468** | **2,061** | **1,788** |
| Canadian crude | 686 | 566 | 2 | — | 688 | 566 | 677 |
| Other foreign | 4,572 | 4,491 | 368 | 92 | 4,940 | 4,583 | 5,493 |
| **Total crude** | **5,258** | **5,057** | **370** | **92** | **5,628** | **5,149** | **6,170** |
| **Total imports** | **6,698** | **7,072** | **398** | **138** | **7,096** | **7,210** | **7,958** |

*Revised. †Included in total motor gasoline. §Includes No. 4 fuel oil.
Source: American Petroleum Institute
Data available in Oil & Gas Journal Energy Database.

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